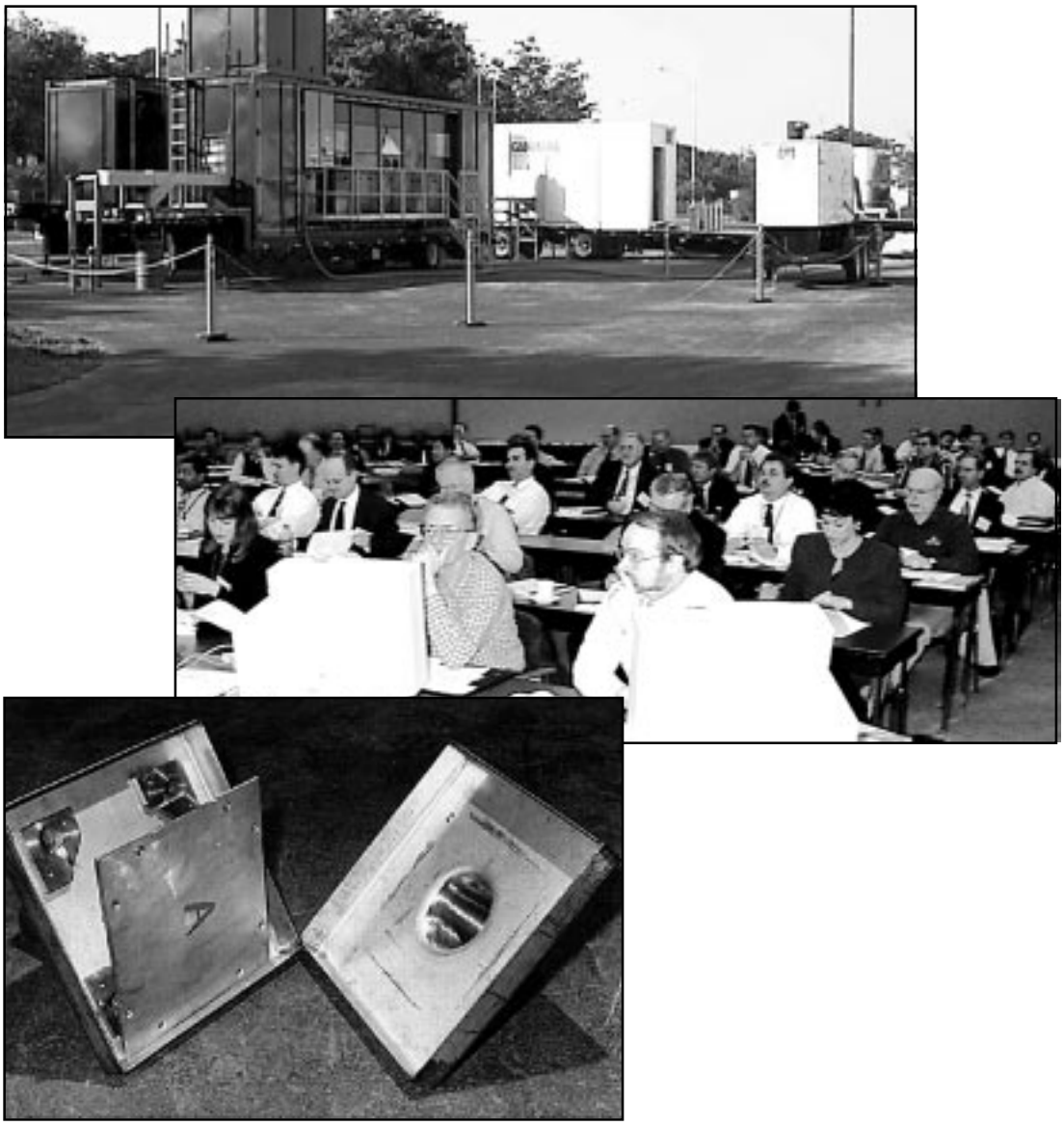
Deactivation and Decommissioning Focus Area

QUARTERLY REPORT – APRIL 2000

January – March 2000 Activities



Office of Science & Technology

NETL

D&D Focus Area

On the Cover

Top Left: The **Mobile Integrated Piping Decontamination and Characterization (MIP-DC) System**, is a field mobile self contained decontamination and characterization system being developed by Florida International University.

Center: **Attendees of the D&D Focus Area 2000 Mid-Year Review** in Morgantown, West Virginia.

Lower Left: The **Vortex Amplifiers** are being demonstrated by AEA Technology at the Savannah River site as part of the International Agreement.

The purpose of this document is to provide an overview of the Deactivation and Decommissioning D&D Focus Area and to update readers on the program's current activities. It presents a synopsis of the current program status and recent accomplishments, along with overviews of planned activities, program issues, and opportunities. Quarterly reports are distributed to U.S. Department of Energy DOE headquarters and operations office managers, site personnel, site operating contractors, technology developers, principal investigators, regulators, and other stakeholders. Issued in January, April, July, and October, the D&D quarterly reports summarize the activities of each preceding quarter. The D&D Update is published in all other months, introducing new projects and highlighting advances in ongoing projects. Quarterly reports, monthly updates, and further information about the D&D Focus Area DDFA are found on the World Wide Web at *www.netl.doe.gov/dd*. Technologies are usually identified by their discrete tracking numbers within the Technology Management System TMS operated by DOE's Office of Science and Technology OST. Providing access to information about OST programs, technologies, and linkages to EM problems, TMS is found on the World Wide Web at *ost.em.doe.gov/tms/home/entry.asp*.

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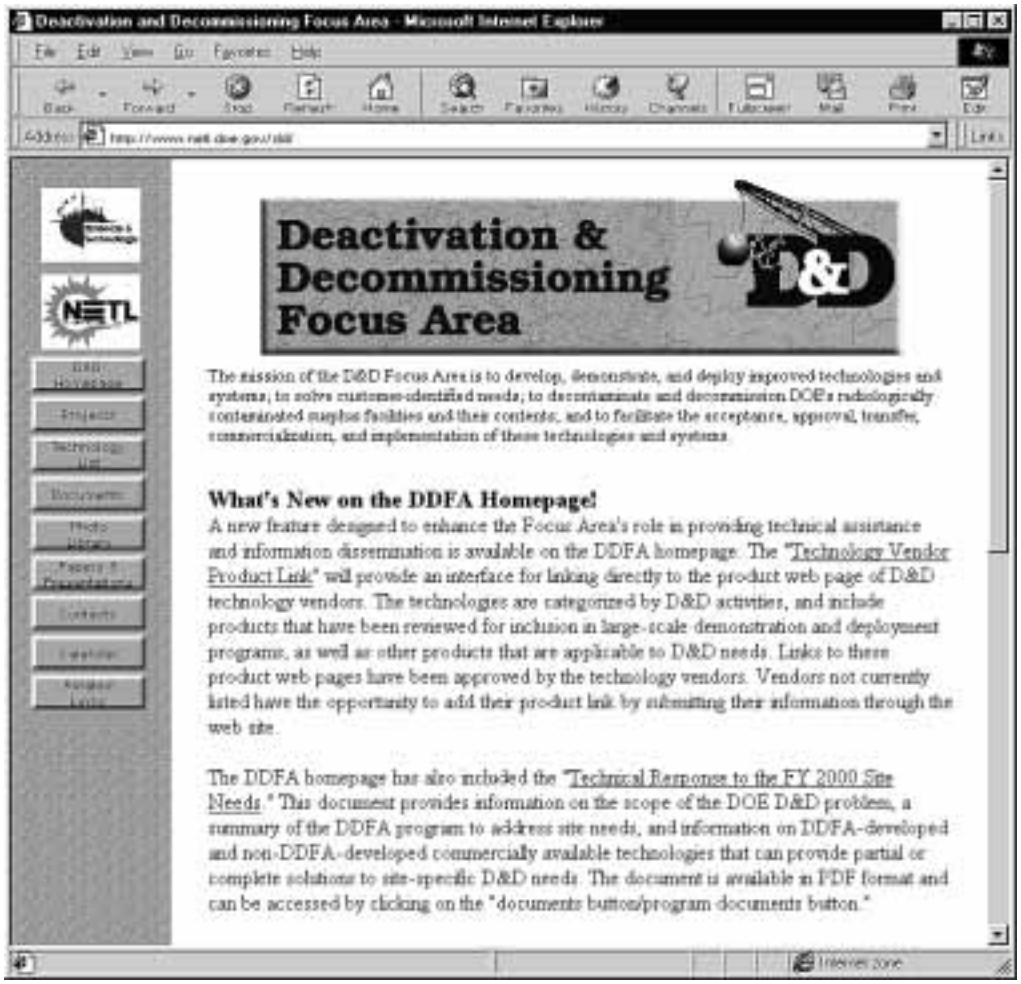
1.0 HIGHLIGHTS

What's New on the DDFA Homepage!

(http://www.netl.doe.gov/dd/)

Beginning in May 2000, a new feature designed to enhance the Focus Area's role in providing technical assistance and information dissemination is now available on the DDFA homepage. *The "Technology Vendor Product Link*" will provide an interface for linking directly to the product web page of D&D technology vendors. The technologies are categorized by D&D activities, and include products that have been reviewed for inclusion in large-scale demonstration and deployment programs, as well as other products that are applicable to D&D needs. Links to these product web pages have been approved by the technology vendors. Vendors not currently listed have the opportunity to add their product link by submitting their information through the web site.

Also in May, the DDFA homepage will also include the "*Technical Response to the FY 2000 Site Needs*." This document provides in-formation on the scope of the DOE D&D problem, a summary of the DDFA program to address site needs, and information on the DDFA-developed and non-DDFA-developed commercially available technologies that can provide partial or complete solutions to site-specific D&D needs. The document will be available in PDF format and can be accessed by clicking on the "document/program documents" button.



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DDFA Holds Mid-Year Review

On March 28-30, 2000, the DDFA held its Mid-Year Review meeting at the National Energy Technology Laboratory (NETL). There were about 125 participants at the meeting, comprised mainly of technology end users from the U.S. Department of Energy (DOE) Headquarters and field locations, DOE site contractors, commercial decommissioning firms, several nuclear utilities, and technology developers and vendors. During the meeting, a review panel evaluated the relevancy and technical merit of the projects managed by the DDFA. The review panel was comprised of four members representing end users from the DDFA Steering Committee and three members from the DOE/Utility Decontamination and Decommissioning Consortium. The review panel rated four criterion for each project, consisting of goals and technical approach, relevancy, technical progress, and future plans. Based on a scale of one to five, with five being the highest rating, the average rating for all projects was 4.3, indicating that the DDFA is substantially satisfying the needs of its customers. No project had an average rating less than 3.0 for any individual criterion, indicating that none of the DDFA's projects has major shortcomings. The 49 presentations made at the meeting included 19 presentations on research and development projects from the Industry/ University Program; Characterization, Monitoring, and Sensors Program; and the Robotics Program. Five presentations were on demonstration projects including 4 Large-Scale Demonstration and Deployment Projects (LSDDP's), and 14 presentations on technology deployments including 12 Accelerated Site Technology Deployment projects. The success of the DDFA is further documented by our customers having deployed about 50 of the DDFA's innovative and improved technologies nearly 200 times causing DOE's deactivation and decommissioning costs to be reduced by millions of dollars.

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DDFA's Technologies Highlighted at Waste Management 2000 (WM 2000)

Improved decontamination and decommissioning (D&D) technologies that were developed, demonstrated, and deployed by the DDFA were a highlight of the WM 2000 Conference. Over 20 exhibit booths featured improved D&D technologies that the DDFA has demonstrated in its LSDDP and/or deployed in its ASTD Projects. In addition, nearly 20 papers or posters over the DDFA's technologies and projects were presented at WM 2000.

WM 2000 proved to be a good opportunity for the DDFA to promote further deployment of improved D&D technologies in its portfolio. Needs identified through contacts made at the meeting promise to result in deployment of improved D&D technologies in the DOE weapons complex and at nuclear power plants undergoing decommissioning. WM 2000 had over 1,400 participants.

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...our customers having deployed about 50 of the DDFA's innovative and improved technologies nearly 200 times causing DOE's deactivation and decommissioning costs to be reduced by millions of dollars.

2.0 Project Summary Table

The following table summarizes the Technical Task Plans for the D&D Focus Area Core Program and related Crosscutting and Industry Program contracts. Project descriptions follow in subsections 2.1 through 2.5 and are organized by the work breakdown structure WBS element listed here.

Project Number	D&D WBS Element	Project Name	Page
AL08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Los Alamos National Laboratory Transuranic Waste	6
OH08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Mound Tritium Facilities	7
SR08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Savannah River Site 321-M Fuel Fabrication Facility	9
ID08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Idaho National Engineering and Environmental Laboratory Fuel Storage Canals and Underwater and Underground Facilities	10
RL08DD21	Demonstrations and Industry Approaches	Canyon Disposition Initiative	11
DE-AC26-99 FT40555	Demonstrations and Industry Approaches	3-D Gamma Ray Imaging Technology	—
DE-AC26-99 FT40556	Demonstrations and Industry Approaches	Non-Intrusive Liquid Level Detection	—
SR09DD61	Demonstrations and Industry Approaches	Highly Selective Nuclide Removal System— Accelerated Site Technology Deployment	13
OH19DD61	Demonstrations and Industry Approaches	Mobile Work Platform— Accelerated Site Technology Deployment	13
RL09DD61	Demonstrations and Industry Approaches	Remote Size Reduction for Large Hot Cell Deactivation— Accelerated Site Technology Deployment	14
NV09DD62	Demonstrations and Industry Approaches	Surface Contamination Monitor— Accelerated Site Technology Deployment	15
AL08SD10	Demonstrations and Industry Approaches	Los Alamos National Lab Decontamination and Volume Reduction System— Accelerated Site Technology Deployment	—
NV09DD61	Demonstrations and Industry Approaches	Oversize Transuranic Waste Laser Cutting System, Nevada Test Site— Accelerated Site Technology Deployment	15
OH19DD62	Demonstrations and Industry Approaches	Personal Ice Cooling System— Accelerated Site Technology Deployment	16
ID08SD11	Demonstrations and Industry Approaches	Integrated Decontamination & Decommissioning— Accelerated Site Technology Deployment	17
ID79DD61	Demonstrations and Industry Approaches	Release of Concrete for Recycle from D&D Projects— Accelerated Site Technology Deployment	18

Project Number	D&D WBS Element	Project Name	Page
CH39DD63	Demonstrations and Industry Approaches	Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites—Accelerated Site Technology Deployment	19
RF09D21 RF08SD10 RF09DD61	Demonstrations and Industry Approaches	Rocky Flats Environmental Technology Site—Accelerated Site Technology Deployment and the D&D Initiative	—
	Demonstrations and Industry Approaches	Deactivation and Decommissioning Consortium	20
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NV05C253	Facility Characterization	Airborne and Ground-Based Laser-Induced Fluorescence	—
DE-AC21-93 MC30176	Facility Characterization	Three-Dimensional Integrated Characterization and Archiving System	26
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RL36DD22	Facility Dismantlement and Material Disposition	Demonstrations of Light-Aided Technologies for Hanford D&D Projects	29
DE-AC21-93 MC30170	Facility Dismantlement and Material Disposition	Advanced Technologies for Decontamination and Conversion of Scrap Metal	—
DE-AR21-93 MC30362	Facility Dismantlement and Material Disposition	Asbestos Pipe-Insulation Removal System BOA	29
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DE-AC21-93 MC30178	Worker Safety/Other	Advanced Worker Protection System	—
DE-AR21-94 MC31190	Worker Safety/Other	Coherent Laser Vision System	—
DE-AC21-93 MC30179	Worker Safety/Other	Protective Clothing Based on Permselective Membrane and Carbon Adsorption	33
DE-AR26-97 FT34314	Worker Safety/Other	Robot Task Space Analyzer	33
FT06IP01	Worker Safety/Other	Integrated D&D Decision Analysis Tool	35
DE-AR26-98	Worker Safety/Other	Modular Manipulator for Robotic Applications	35

2.1 Demonstration and Industry Approaches

Crates of plutonium-contaminated gloveboxes stored at Los Alamos National Laboratory (LANL) are destined for permanent disposal at the Waste Isolation Pilot Plant (WIPP)

▼LANL TRU Waste Characterization, Decontamination, and Disposition LSDDP

Objective and Scope: The Los Alamos National Laboratory (LANL) TRU Waste Characterization, Decontamination and Disposition Large Scale Demonstration and Deployment Project (LSDDP) addresses the characterization, decontamination and volume reduction of oversized metallic transuranically contaminated (TRU) waste currently in storage at LANL's storage and disposal area, TA-54. The LANL LSDDP reflects the cooperative interest of industry, government and academia to bring collaborative expertise and strength to DOE's TRU decontamination and decommissioning program at LANL and elsewhere within the DOE complex. LANL currently has 1,500 m^3 of TRU waste in inventory — 313 plutonium-contaminated gloveboxes in a 24,000 ft^2 facility—and expects to generate another 2,500 m^3 from ongoing operations in coming years.

The major objectives of this LSDDP are to:

- Identify technologies that are ready for deployment for the characterization, decontamination and volume reduction of TRU waste/TRU contaminated metallic objects
- Identify technologies that are ready for demonstration
- Demonstrate those technologies with potential to reduce cost, risk, and schedule and that are amenable for direct field application at Los Alamos and elsewhere in the DOE complex
- To the extent possible, compare technologies "side by side" with baseline approaches to evaluate their advantages (cost, risk, schedule) and refine/validate baseline assumptions
- Capitalize on the combined corporate management and technical strength of private industry, government and academia
- Demonstrate a leveraged funding pool of federal and private monies via cost sharing to address issues of national importance
- Provide ready access to demonstration results through an aggressive communication program

To date, the LANL LSDDP has demonstrated the following five technologies: the AeroGo air pallets, the SAIC Vehicle and Cargo Inspection System (VACIS) for real-time radiography (RTR) of crates, the Mobile Characterization Services transportable X-Ray for RTR of crates, the Nukem RASP for sectioning gloveboxes, and the Mega-Tech hydraulic cutter.

Status and Accomplishments: As part of the NETL-sponsored LANL LSDDP, a Mobile Characterization System (MCS) from VJ Technologies was demonstrated for non-intrusive inspection of fiberglass-reinforced plywood (FRP) crates containing TRU waste from LANL. The MCS uses a turntable and conveyor to move a crate into a shielded vault where x-rays bombard the crate and produce visible images of its contents. The maximum crate size that can be imaged with the MCS is about 9 feet by 6 feet by 6 feet. The output of the MCS is a video recording of a continuous x-ray as it

Mega-Tech Blade Plunging Cutter at LANL LSDDP at the FIU-HCET

proceeds along the crate, while imaging a 6-inch by 6-inch section at any instant. In the demonstration, the MCS provided detailed images of 18 FRP crates, including the identification of plastic bags, nails, electrical connectors, wires, piping and fittings. It took 20 to 60 minutes to image a crate, depending on crate dimensions and contents. The images from MCS will enable LANL to prioritize the order to open the crates (based on their contents), identify crates containing mixed waste because of lead shielding, and plan the best approach to open each plywood crate based on the location of items inside the crate. Without these images, LANL must rely on 20-year-old documentation describing the contents of boxes. Imaging the plywood crates greatly improves safety to those workers who open the crates, which is vital because the crates contain plutonium gloveboxes and other TRU materials. As one example of the safety benefit, MCS identified several problematic conditions, including a vessel containing liquid and an aerosol can inside the crates.

The Base Phase for Thermopower's Alpha Continuous Air Monitor (CAM) has been extended. A cost and schedule estimate was received for work proposed to extend the base phase of this project. The proposed work will better position Thermopower Alpha CAM for a deployment at a site in the future by demonstrating their current prototype CAM unit. Deployment may possibly be in conjunction with the TRU Waste Characterization, Decontamination and Disposition LSDDP.

For more information:

http://www-emtd.lanl.gov/LSDDP/DDtech.html

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▼Mound Tritium D&D LSDDP

The Mound Plant in Miamisburg, Ohio commenced operation in 1948.

Objective and Scope: The Mound Plant in Miamisburg, Ohio began operations in 1948. The site's mission, originally to fabricate the neutron initiator for the atomic bomb, expanded to include research, development and production of numerous nuclear and non-nuclear weapons components, production of radioisotopically fueled thermoelectric generators and surveillance of nuclear weapons components.

The objective of the Mound Tritium D&D LSDDP is to identify, demonstrate and evaluate innovative technologies applicable to the decontamination and decommissioning (D&D) of tritium facilities. D&D of Mound's surplus tritium facilities, the T and R/SW Buildings, provides a unique opportunity to compare, evaluate and eventually execute innovative D&D technologies alongside baseline technologies in an ongoing project. The Mound LSDDP will identify and explore methods to improve worker safety while achieving cost and schedule savings. The project is expected to identify technologies that, when implemented in the Mound LSDDP, will produce significant savings on the $57.8 million baseline. The results and successes of this demonstration project will benefit similar DOE facilities and projects.

The Technical (T) Building is an underground reinforced-concrete structure built in 1948 for the purification of polonium-210 used in nuclear weapons initiators. Later the facility was used to extract other radionuclides, house the plutonium verification facility and store TRU materials. Facilities large enough to handle multikilogram quantities of tritium were added to the building.

Current plans are to decontaminate T Building so as to potentially allow unrestricted public reuse by the year 2003. The SW Complex and one corridor of rooms in the adjacent R Building form the SW/R Complex. Four types of operations have been performed in these facilities to support nuclear weapons programs using tritium: component development, component evaluation operations, tritium recovery, and material analysis. To meet DOE's vision of completing the environmental restoration of the site by 2005, the SW/R Tritium Facilities will be demolished and contamination beneath the building will be removed.

It is anticipated that innovative technologies will be applied to the following decontamination tasks:

- tritium-contaminated gloveboxes
- tritium characterization techniques
- productivity improvement technologies
- tritium specialties decontamination
- piping system removal and disposition
- mixed waste treatment and disposal
- tritiated water treatment
- contaminated water plume under SW building
- miscellaneous rad/non-rad traditional building materials disposition

The Mound LSDDP IC Team includes Babcock & Wilcox of Ohio, Lawrence Livermore National Laboratory (LLNL), British Nuclear Fuels Limited (BNFL), Foster Wheeler, IT Corp, LANL, Westinghouse Savannah River, Princeton Plasma Physics Laboratory (PPPL) and Florida International University.

The Tritium Clean-Up Cart was demonstrated as part of the Mound LSDDP

Status and Accomplishments: Completed Demonstrations:

1. ***Portable Scintillation Counter (OST/TMS ID 2311)***: The Lumi-Scint portable scintillation counter is a portable, single-tube liquid scintillation counter that can be set to respond to the low-energy beta radiation from tritium. It uses a single photomultiplier tube and manual sample chamber. The Lumi-Scint can be run from an internal battery or 110 vAC for its operation. The unit can be obtained with a printer, which allow hard copies of its electronically stored data.

2. ***Water Solidification (OST/TMS ID 2312)***: This technology uses polymer-based absorbent (Waterworks SP-400) that can be used to solidify aqueous waste. It is similar to other polymer-based absorbents that offer benefits over traditional solidification agents such as cement or the Mound facility baseline solidification agent Aquaset. Benefits include a high liquid to absorbent ratio; no mechanical mixing is required to promote the absorption process; there is little to no volume in-crease in the waste form after addition of the absorbent; and a very high retention in the form of the gel-like material.

3. ***Oil Solidification (OST/TMS ID 2313)***: This contaminated oil solidification technology—NOCHAR Petrobond®—is a high-quality polymer offered by NOCHAR®, Inc., of Indianapolis, Indiana, and is specifically designed as a petroleum-based liquid absorbent. The Petrobond® absorbs very quickly with little increase in volume. The Petrobond® can be used for free-liquid control in storage, transport, and disposal of low-level radioactive waste.

4. ***Tritium Clean-Up Cart (OST/TMS ID 2974)***: The Tritium Clean-Up Cart is a portable tritium processing system Clean-Up Cart. Used as a stand-alone cart for scrubbing tritium effluent, it provides a scrubbing process based on catalytic oxidation of tritium. Tritiated water is collected on removable molecular sieve dryers, which can be shipped as low level waste below the 1080 curie "Type A" limit. The unit provides a projected decontamination factor of greater than 1000, with a process flow rate of 45 l/min. Design features include: mole sieve dryer beds configured in series with moisture monitors to prevent moisture breakthrough; process flow controllers in the main plumbing loop and air inlet system; process thermocouples, which provide process stream and enclosure over-

temperature control; and an enclosure that can function as a ventilated hood during normal operating conditions, but can be isolated when tritium concentrations inside the enclosure exceed the pre-selected control setpoint.

5. ***Pipe Cutting and Crimping System (OST/TMS ID 2955)***: The Pipe Cutting and Crimping System is a small hand-held, battery-operated crimping tool manufactured by Burndy Products. This tool utilizes a separate hydraulic pump with a high-pressure hose connected from the pump to the crimping head. U-shaped dies are contained in the head for crimping. A battery powered hydraulic pump or electric-powered pump can be used to develop 10,000 psi of pressure to the crimping head. A total of 30 crimping operations can be performed before recharging is needed. The small dimension and lightweight make this tool very suitable for crimping in tight quarters.

Current Reporting Period Activities: During the second quarter of FY 2000, most of the activities are focused on documenting results of previously demonstrated technologies and planning for upcoming demonstrations. Demonstrations planned during FY 2000 include the Passive Air and Surface Tritium Monitor, Fiber Optic Tritium Detector, Photo-Diode Scintillation Tritium Detector, Stable Tritiated Particulate Surface Area Monitor, SAMMS Heavy Metals Adsorbent and Enthrall Heavy Metal Adsorbent.

For more information:

http://www.doe-md.gov/lsdd/lsdd.htm

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Savannah River Site 321-M Fuel Fabrication Facility Deactivation LSDDP

Objective and Scope: The deactivation of Savannah River Site's 321-M Fuel Fabrication Facility is the first LSDDP the DDFA is sponsoring with the Office of Nuclear Material and Facility Stabilization. This60,000-ft^2 facility currently has small quantities of highly enriched uranium reactor fuel material that requires special control and accountability. Once the material is removed and the deactivation is complete, the facility will be much less expensive to maintain. Five innovative and improved technologies will be demonstrated in key areas, including characterization, decontamination, dismantlement, and waste management. The potential cost savings and mortgage reductions are estimated to be $20 million.

The IC Team (ICT) for this project includes representatives from Florida International University, the U.S. Army Corps of Engineers, Duke Engineering and Services, Westinghouse Savannah River Company, and Bechtel National-Oak Ridge.

Status and Accomplishments: The following technologies have been demonstrated as part of the SRS LSDDP.

- Long-Range Alpha Detector (OST/TMS ID 2382)
- X-Ray K-Edge Heavy Metal Detection System (OST/TMS ID 134)
- Strippable Coatings (OST/TMS ID 2314)
- Size Reduction Machine (OST/TMS ID 2395)
- Electret Ion Chamber (OST/TMS ID 2315)

Current Reporting Period Activities:
The Savannah River Site (SRS) wrapped up the 321-M Fuel Fabrication Facility LSDDP in December 1999. Five improved characterization, decontamination and dismantlement technologies were successfully demonstrated during the life of the project. Three of the five are being used to improve the safety and cost-effectiveness as clean up continues at the 321-M Building. The E-PERM Electret Ion Chambers, is an alpha surface monitor that uses passive detectors to make sure that decontaminated areas meet residual contamination release criteria. This technology provides improved sensitivity to low levels of contamination, improved accuracy, reduced personnel exposure, reduced potential for contamination and reduced costs. The ALARA 1146 Strippable Coating is used to remove surface contamination without producing secondary liquid waste. An adhesive plastic coating is applied to a contaminated surface. After it is allowed to dry, it is peeled off the surface, taking the contamination with it. The ALARA 1146 Strippable Coating has proven to have superior characteristics and is now being used at other facilities across the SRS. The Size Reduction Machine (SRM) is a manually positioned, remotely operated hydraulic shear capable of shearing up to 15 feet above floor level. The hydraulic shears are capable of cutting 3" by 3" stainless steel angles, 4" schedule-40 pipes or a 3.5" by 0.5" flat bar. The SRM improves the safety and efficiency of dismantlement and waste handling operations. The resultant size-reduced waste is easier to handle and results in the generation of fewer waste containers. These technologies have been added to the site's "toolbox" of technologies for application at other SRS D&D projects. The SRS has completed all of the Innovative Technology Summary Reports (ITSR's) and the final report on the LSDDP, which can downloaded at *http://www.netl.doe.gov/dd/.*

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INEEL Fuel Storage Canals and Associated Facilities LSDDP

Objective and Scope: The Idaho National Engineering and Environmental Laboratory (INEEL) Fuel Storage Canals and Associated Facilities LSDDP is led by an IC Team consisting of Parsons Engineering, British Nuclear Fuels Limited, Lockheed Martin Idaho Technologies Company, TLG Engineering, Florida International University, and Idaho State University. This LSDDP will utilize funding, technologies, and expertise from the Offices of Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization; industries; universities; and the international community.

The project includes the following areas:

- *Test Reactor Area TRA-660*, housing two underwater research reactors, the Advanced Reactor Measurement Facility and the Coupled Fast Reactivity Measure-ment Facility, with a 30,000-gal interconnecting water canal that was sometimes used for fuel storage. These facilities were utilized for reactivity insertion experiments that were later scaled up for experiment design in larger reactors. The two reactors achieved criticality in 1960 and 1962, respectively. Neither has operated since February 1991. Contamination includes radioactive elements, lead, and chromium.
- *TRA Filter Pit system*, consisting of five structures containing large filters associated with test reactor operations. The facilities are contaminated with lead, radioisotopes, and deteriorating asbestos. The filters are located in restricted entry pits, and work will have to be done remotely and in confined spaces.
- *TAN-620 Initial Engine Test Control Room*, a massive underground, shielded, heavily

reinforced concrete structure that served as the control center for the engine tests in the Aircraft Nuclear Propulsion Program conducted at INEEL in the late 1950s and 1960s. Contamination includes asbestos, mercury, lead, and some potential radiation.

This LSDDP is a high priority for the DOE/Commercial Nuclear Utilities D&D Consortium, with demonstrated technologies having deployment opportunities in the nuclear utility market through the consortium. Resulting deployments throughout the DOE complex alone could generate a potential cost savings and mortgage reduction of $20 million.

Eleven to 18 innovative and improved technologies will be demonstrated in the areas of underwater inspection, characterization, and dismantlement; inspection, characterization, and dismantlement in restricted spaces; recycle of materials from D&D activities; removal of loose radiological contamination on walls, floors, piping, and equipment; removal of fixed radiological contamination on concrete; tank, vessel, and piping decontamination; lead plate radiological decontamination; and high-radiation exposure fields.

Current Reporting Period Activities: The PCB Analyzer, which was demonstrated in 1999, was deployed on a number of occasions during the period. This screening tool allows D&D Operations to make immediate determinations for dispositioning rooms and facilities, rather than wait the typical 30-90 days for conventional laboratory results.

- *The Remote Underwater Characterization System (RUCS)*, which was demonstrated in August 1998 at the INEEL, was deployed at the Material Test Reactor canal on February 29, 2000. The RUCS is a small, remotely operated submersible vehicle that provides visual and gamma radiation detection and characterization.
- *The Paint Scaler*, which was demonstrated in September 1999, was deployed on January 5, 2000, at Test Reactor Area (TRA) in the Gamma Building. This technology is used to collect paint samples.
- *The Lead Paint Analyzer*, which was demonstrated in 1999, was deployed in TRA North, at the Decon Shop (TAN-607). This technology is used to determine the levels of lead contamination in paints.

The IC Team is currently working with DOE and the Research and Development Institute of Construction Technology (NIKIMT) in Moscow, Russia, to demonstrate a Russian technology. The technology is a non-tethered 3D-Gamma Locator Device (GLD) that provides three-dimensional characterization of radioactivity in areas of high levels of radioactivity. It is a robotic unit that provides results to a computer-based control system. The first phase testing of the technology was successfully accomplished during the period, in Russia. Work is proceeding to bring this technology to the INEEL for demonstration.

The In Situ Object Counting System for "free release" of decontaminated areas was initiated in October 1999 and continued into this reporting period.

For more information:

http://id.inel.gov/lsddp/

OST/TMS ID 2202

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Canyon Disposition Initiative

Objective and Scope: The Hanford Canyon Disposition Initiative (CDI) Project was initially a collaborative project that included participation across the DOE Office of Environmental Management (EM). Participating EM offices included the Offices of Waste Management Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization. This partnership was driven by the broad and significant impact that decisions made on the disposition of the canyons would have to all of these programs. Due to a recent reorganization of EM on September 1, 1999, CDI will

now be overseen by the newly created Office of Project Completion.

The CDI Project is evaluating the feasibility of using the five chemical processing facilities (canyons) as assets for disposal of low-level wastes, instead of a mortgage liability. The U Plant facility is being used as a pilot for this evaluation. The DOE Richland Operations Office (RL) Environmental Restoration Program signed an Agreement in Principle with the regulators at the beginning of FY 1997, to conduct the evaluation for the disposition alternatives for the canyon facilities. In 1996, a Canyon Task Team of personnel from RL, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (known as the Tri-Parties) conducted a series of workshops to identify an approach for the long-term disposition of the five main processing facilities in the 200 Area (B Plant, T Plant, U Plant, Plutonium Uranium Extraction Facility and the Reduction Oxidation Plant) at the Hanford Site. The assessment made by the Canyon Task Team centered on the possibilities of removing the processing facilities, leaving all or part of the facilities in place and identifying alternative beneficial uses for the facilities. The team concluded that the technical approach for dispositioning any of the facilities could be bounded by the following seven alternatives:

- Alternative 0: No Action
- Alternative 1: Full Removal and Disposal
- Alternative 2: Decontaminate and Leave In Place
- Alternative 3: Entombment with Internal Waste Disposal
- Alternative 4: Entombment with Internal/ External Waste Disposal
- Alternative 5: Close In Place—Standing Structure
- Alternative 6: Close In Place—Collapsed Structure

The Record of Decision for the 221-U Facility will generate regulatory and technical precedence for future disposition of the other four remaining processing facilities.

Demonstration of the Infrared-based Liquid Level Detection LLD technology as part of the Canyon Disposition Initiative.

Hanford Canyon Building

Current Reporting Period Activities:
Preparation of the survey plan for the structural assessments, including the ventilation tunnel has begun. The concrete coring unit has been procured and received at the site. The concrete coring unit will be used to obtain samples to support the structural assessments and to determine whether or not potential contaminants have migrated beyond the confines of the cells. The concrete sampling will require the repair of the railroad tunnel roll-up door to provide access to both the railroad tunnel and the cells. The cover blocks for the railroad tunnel have to be replaced to perform the repair of the roll-up door and to permit access for the coring equipment to the canyon facility. The crane that is used to place the cover blocks had non-destructive examinations of the cable drum performed during the period. The crane is now available to support the roll-up door repair and is being used for process cell inspections.

Plans have been developed for the inspection of the canyon facility 24-inch drainpipe. A robotic device is planned to be inserted at the drain pipe outfall in cell ten to characterize the drain. Provisions are being made to address encountering any obstructions in the drainpipe during the inspection.

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Highly Selective Nuclide Removal System—Accelerated Site Technology Deployment

Objective and Scope: In 1992, the last of the five DOE production reactors at the SRS was placed into shutdown mode, with no intention to restart. With this action, the site entered into an extensive deactivation and long-term surveillance and maintenance life-cycle phase of these facilities. The integrity of the aging facilities has become a concern in recent years. Large volumes of contaminated water exist at some of these facilities at the SRS (for example, fuel storage and disassembly basins). Treatment of this water requires removal of the water from the basin and shipment to the F and H Area Effluent Treatment Facility (ETF). A technology that is cost-effective and safe is needed to process the basin waters on location and selectively remove radioactive materials without transporting the water to ETF. The technology must reduce targeted nuclides to near DOE release limits and condition the water for direct release. Efforts to address these concerns have been initiated under the current funding for reactor monitoring and are being incorporated into the overall facility deactivation, decontamination and decommissioning planning strategy. With the uncertainty of the basin integrity over time, a technology that can remove radioactive contamination from the basin water while minimizing secondary waste generation is essential to the success of the deactivation of the DOE reactor basins.

The SRS Accelerated Site Technology Deployment (ASTD) project will deploy an innovative, highly effective water treatment system to remove selected radionuclides from millions of gallons of water. Overall, deactivation and decommissioning life-cycle costs are expected to be significantly lowered via deployment of the technology.

Status and Accomplishments:
3M's EMPORE technology is being readied for deployment at the SRS R-Basin. Lead shielding installation on the 3M EMPORE system was completed in the middle of march, and startup of the system is expected the beginning of April. It will be deployed for at least two months, and may be used with the Selion system in parallel.

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Mobile Work Platform—Accelerated Site Technology Deployment

Objective and Scope: This ASTD project involves a partnership between the Fernald Environmental Management Project (FEMP) and Idaho National Environmental and Engineering Laboratory (INEEL) to purchase and deploy a Mobile Work Platform (MWP) at Fernald and the INEEL and potentially at other DOE Sites including Hanford, Rocky Flats and the Savannah River Site.

Five major complexes, Plants 7, 4, 1, Boiler, and 9, at the FEMP site have been successfully decontaminated and decommissioned (D&D) during the course of ongoing environmental restoration activities pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Major complexes, Plant 2, Plant 8, and the Pilot Plant, will undergo D&D activities in FY 2001 and FY 2002. In addition to the FEMP facilities, the INEEL Test Area North—Building 616 has also been identified as a deployment location.

To address the sites' needs, Fernald and the INEEL will develop a common specification and then purchase a MWP that satisfies both sites' needs.

Status and Accomplishments:
While the FEMP achieved cost and schedule improvements with each successive D&D project, D&D of the major projects was

expensive and labor intensive. Of particular concern during past, present and future D&D projects is the removal of "process" piping. Removal of process piping presents two concerns. The first is a personnel safety concern. The workers, impaired by several layers of personal protective clothing and a full-face respirator, have to handle power tools while working off the ground on ladders, scaffolding and/or man-lifts. The second concern is the close proximity, within inches, that the workers have to be to a radiation/contamination source (process piping). This concern has been formally documented at FEMP by the Site Technology Coordination Group (STCG), Need Number OH-F010, "Safe and Efficient Process Piping and Conduit Dismantlement." This is the highest priority of Fernald's documented D&D needs. Use of a MWP will remove the workers from the immediate industrial hazard and radiation/contamination zone, which will significantly increase the safety of the pipe/conduit removal process.

A Deployment Plan has been written and issued. Detailed requirements and specifications are being developed. Operator training and initial deployment will be completed by the end of FY 2000.

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Remote Size Reduction for Large Hot Cell Deactivation-Accelerated Site Technology Deployment

Objective and Scope: The 324 Building, located at the Hanford Site near Richland, Washington, is being deactivated to meet state and federal cleanup commitments. The 324 Building has several highly radioactive tanks, tank vaults, piping and large hot cells containing complex chemical processing equipment. To meet the cleanup commitments, there is a need to deploy more rapid and remote size-reduction, debris collection and removal, characterization and decontamination methods. Readily deployable deactivation methods that reduce worker exposure, secondary waste generation, costs and risks are also needed. Deployment of a remote/robot work platform in the 324 B-Cell with full reach capabilities will significantly accelerate work tasks, eliminate the need for multiple, specialized tool design and procurement and reduce the overall program risks.

The Hanford Site ASTD project will fund the deployment of a robot work platform to support 324 B-Cell cleanup activities. Through this project, Hanford will procure and deploy a remote/robot work platform that is positioned with an overhead crane to perform deactivation activities. Following B-Cell cleanup, the work platform will be deployable for other 324 and Hanford site cleanup missions.

Status and Accomplishments: The French firm Cyberneteix was awarded the contract for the remote/robotic platform that will be deployed at the 324 facility hot cells. The remote/robotic platform will help facilitate rapid remote size reduction, debris collection and removal, characterization and decontamination operations to enhance deactivation of the hot cell complex to meet state and federal cleanup requirements. Deployment of the new system will reduce worker exposure, secondary waste generation, cost and risk. Current baseline operations utilize overhead cranes and mechanical manipulat or systems.

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Surface Contamination Monitor Accelerated Site Technology Deployment

Objective and Scope: The objective and scope of this Nevada Test Site (NTS) ASTD project is to deploy a Surface Contamination Monitor and Survey Information Management System (SCM/SIMS) from Shonka Research Associates (SRA). The SCM/SIMS will be deployed at the Test Cell C facility, which was used for testing nuclear rocket reactors. The facility has a large exterior concrete pad and interior floor spacing requiring survey. The SCM/SIMS will be used for the radiological characterization of concrete floors in order to expedite survey and closure at a reduced cost and risk. Use of SCM/SIMS is expected to be extremely beneficial in characterizing the Test Cell C facility, and is expected to be deployed at other NTS facilities including the Pluto facility.

Status and Accomplishments: The NTS submitted a draft Cost and Performance Report to the DDFA based on the very successful deployment of the SCM/SIMS at the NTS. Over 3700 square meters were surveyed using the SCM/SIMS. Surveying productivity was more than an order of magnitude greater for the SCM/SIMS, and the total cost was several times less than the baseline technology. Initial SCM/SIMS deployment at NTS was completed early in FY 2000. Clearly, the SCM/SIMS deployments at the NTS, via the ASTD program, exemplify the intent and value of the OST's program. The program provided a minimal level of "seed" funding to effect widespread use of a technology that has proved to be vastly superior to baseline technologies. The NTS is discussing/negotiating the use (acceptance) of SCM/SIMS with Nevada regulators, as the new baseline for clearance surveys across the site. The DDFA will promote the successful NTS deployments of the SCM/SIMS throughout the DOE, to support additional deployments and commensurate cost savings.

A technology deployment fact sheet was developed and will be updated based on the information from the cost and performance report for this technology.

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Oversize TRU Waste Laser Cutting System at the Nevada Test Site—Accelerated Site Technology Deployment

Objective and Scope: Deploy a laser cutting system at DOE-NV to reduce the size of contaminated TRU waste so that it fits in the WIPP shipping containers, and also deploy the laser cutting system to Hanford and Rocky Flats to size-reduce TRU waste so that it can be put into containers and shipped to WIPP. DOE-NV has a need to size-reduce and characterize 58 oversized TRU-contaminated metal boxes (total volume of 270 cubic meters) prior to shipping them to WIPP. The contents of these boxes are contaminated gloveboxes (32), a metal cutting lathe, lengths of metal piping, lengths of angle iron and various scrap metal. The Hanford material requiring size reduction includes a minimum of 150 gloveboxes (there are also duct work and piping). There is actually much more material to be processed, but the economics in this proposal are based on 150. At Rocky Flats, the laser cutting system will also be applied to contaminated gloveboxes (proposal is based on 150).

Status and Accomplishments: Things are really beginning to move. LANL and Fluor Daniel Hanford have submitted their draft FY 2000 task plans. The task plans, however, exceeded the available FY 2000 funding, so they are now being revised. Once approved, these plans will allow DOE-Nevada to release the $710K in FY 2000 funds. The laser, chiller and trailer have been purchased, and they are currently

being stored at the trailer installation vendor's site. The robotic arms; the rotational indexing table; the control station; and the installation of the laser, chiller and control station in the trailer await FY 2000 funds. These funds will be released very soon. The latest deployment schedule shows the laser cutting equipment being installed at the LANL Decontamination and Volume Reduction System (DVRS) building site in November 2000, with full-scale operation beginning around April 2001.

During this quarter, the Albuquerque Waste Management personnel reviewed a project plan on the deployment at the LANL in the DVRS building, once it is completed. The planned deployment date for the laser is now April 2001. The reason for this slippage in the deployment is the DVRS building will be housing three other ASTD technologies, and they are the prime subjects of a Safety Analysis Report (SAR) evaluation and modification for LANL. The SAR is too far along to include the laser cutting system. Once the SAR modification is complete, Albuquerque will begin a second modification to include the laser cutting system. In this manner, the original three ASTD projects located in the DVRS building can proceed as planned without being delayed for the laser cutting system to catch up.

Lastly, DOE-NV management has made a difficult decision to move their oversized TRU waste offsite for downsizing, certification and eventual shipment to WIPP. The offsite location is Albuquerque. Therefore, it is uncertain whether or not the laser cutting system deployment will occur at the NTS. However, the laser TRU waste cutting system deployment in the DVRS building at LANL may turn out to include NTS TRU waste, anyway. DOE-NV project personnel are still working with Rocky Flats to work out a deployment there.

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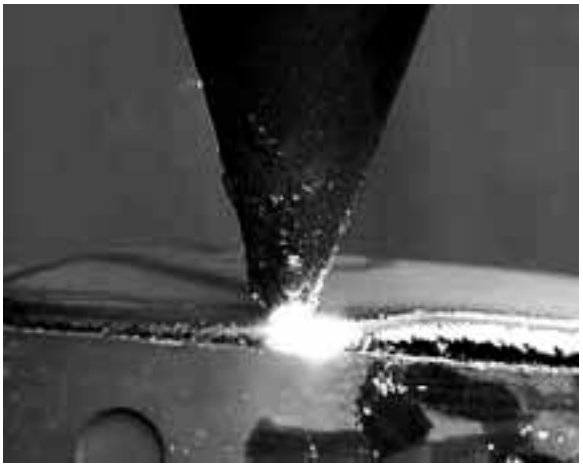

The Oversize Transuranic Waste Laser Cutting equipment from GSI Lumonics is used in ASTD to diminish the size of TRU waste to fit into WIPP containers.

▼Personal Ice Cooling System (PICS)—Accelerated Site Technology Deployment

Objective and Scope: The objective of the PICS cool suit technology (OST/TMS ID 1898) is to control the heat stress of workers. This project is designed to deploy the PICS cool suit personal protective equipment to Fernald's workforce as well as to other DOE sites. Fernald will also implement administrative and educational programs designed to overcome cultural barriers and replace the existing baseline with the PICS. PICS is a self-contained core body temperature control system that uses ordinary ice as a coolant and circulates cool water through tubing that is incorporated into a durable and comfortable, full-body garment (pants, shirt and hood). Water is frozen in bottles that are worn outside/inside of Anti-C's in a sealed, insulated bag with a circulating pump attached to a support harness system. An adjustable-rate, battery-powered pump circulates the chilled water through the tubing in the suit. The adjustable pump allows the worker to control his temperature based upon his workload, unlike “ice vests” where the initial cooling is often extreme and uncomfortable. The ice bottle, pump and suit make up only 12 pounds, a relatively small load. This effort provides the project team with nearly 100 PICS units as well as several central chillers and all required support equipment for deployment. The team will deploy various PICS cool suit systems (the three-piece [hood,

shirt, and pants] suits and/or vests) to over ten additional DOE sites by a team of Fernald personnel. This team will conduct proactive workshops on the PICS and its benefits to the workforces at the other DOE sites (Nevada Test Site, Hanford, Oak Ridge, Paducah, Savannah River, Rocky Flats, Pantex, Los Alamos, Sandia, Mound, Lawrence Livermore, and Carlsbad). It is envisioned that the educational workshops coupled with leaving "seed" PICS systems will create a demand for the PICS at the other DOE sites. This approach to widespread deployment using experienced workforce personnel is similar to the successful approach Fernald used to achieve widespread deployment of the oxy-gasoline torch. Not only will Fernald see the cost savings realized by using the PICS, but other DOE sites will, as well

Status and Accomplishments: During FY 1999, 80 PICS units were deployed at 11 DOE Sites (Nevada Test Site, Hanford, Oak Ridge, Paducah, Savannah River Site, Fernald, Sandia, Los Alamos, Pantex, Rocky Flats, and Mound). The deployments were timed to correspond with the beginning of the summer/heat stress season. In initiation of the deployments, training on the PICS was provided to over 200 people. Also, 25 PICS units and two central chilling units have been deployed (Laundry, Sample Line) at Fernald, and an additional order within another division for 10 PICS ($15K). Feedback from all of the sites with regard to the deployments has been extremely positive. As a result, the PICS vendor received additional PICS orders in June from three sites (Savannah River, Paducah, Oak Ridge) and one in July from INEEL; these all total around $65K. Rocky Flats, Pantex and Sandia are considering the purchase of additional PICS cooling suits. Directly and indirectly related to this project, over 150 PICS cooling suits have been deployed across the DOE complex.

Current Reporting Period Activities: During the second quarter of FY 2000, the PICS ASTD project completed a technology transfer agreement with the University of Findlay in Findlay, Ohio under which the University's Environmental Resource Training Center (ERTC) will receive 10 PICS cool suit systems for training purposes. The ERTC trains about 9,000 workers each year in environmental remediation techniques. These workers include DOE, EPA, local fire departments, private industry and universities. Additionally, during the current reporting period, 10 PICS cool suit systems and training were provided to the DOE Office in Carlsbad, New Mexico.

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Integrated Decontamination & Decommissioning – Accelerated Site Technology Deployment

Objective and Scope: The overall objective of the Integrated Decontamination and Decommissioning (ID&D) ASTD project is to increase the use of innovative/improved but proven technologies on a large-scale in the D&D of facilities in the DOE weapons complex. The reason for increasing the use of these innovative/improved technologies is that each has demonstrated improvements over current baseline methods in cost, schedule, waste generation, radiation exposure or safety. Increased use on a large-scale will be accomplished by doing actual D&D projects with the selected innovative/improved technologies, thereby increasing user familiarity and experience with them and adding them to the array of tools available for D&D projects. The technologies added to the D&D toolbox have all been proven on a smaller scale, either through demonstration in the DDFA's LSDDP's or through commercial use, but they have not been used to decontaminate and decommission facilities across the DOE complex. After completing the ID&D ASTD project, the DOE expects to see increased use of these technologies that will result in ongoing cost savings at the INEEL, Fernald Environmental Management Project (FEMP), Argonne National Laboratory-East (ANL-E) and other sites in the DOE

complex. The ID&D ASTD project will provide for implementation and deployment of a suite of around 12 D&D technologies. These technologies will be deployed at over 20 deployment sites (facilities) at the INEEL, FEMP, and ANL-E. The anticipated technologies included: oxygasoline torch; track-mounted shear; hand-held shear; GammaCam; Remote Control Concrete Demolition System; Decontamination, Decommissioning, and Remediation Optimal Planning System (DDROPS); soft-sided waste containers; snap-together scaffolding; concrete crusher; Personal Ice Cooling System (PICS); lead paint analyzer; paint scaler; and PCB analyzer.

Status and Accomplishments: During the project, the FEMP project team performed D&D on nine facilities 3F, 3G, 8F, 22A, 24B, 38A, 38B, 39C, and 45B and dismantled and demolished them utilizing the oxy-gasoline torch (OST/TMS ID 1847), hand-held shear (OST/TMS ID 2304) and track-mounted shear-crusher (OST/TMS ID 2303) technologies. At the INEEL, the following 7 technologies were deployed in some 11 facilities during FY 1999: Oxygasoline Torch (OST/TMS ID 1847), GammaCam (TM) Radiation Imaging System (OST/TMS ID 1840), Remote Control Concrete Demolition System (OST/TMS ID 2100), DDROPS (OST/TMS ID 2322), Soft-Sided Waste Containers (OST/TMS ID 2240), EXCEL Automatic Locking scaffold (OST/TMS ID 2320), and the Personal Ice Cooling System (PICS) (OST/TMS ID 1898). During the project, the Argonne-East team deployed a Remote Control Concrete Demolition System for the demolition of the CP-5 reactor bioshield; they also used the Oxygasoline Torch for cutting reinforcing bars in the concrete and other metals in the reactor service area.

Current Reporting Period Activities: In the second quarter of FY 2000, the project deployed the Lead Paint Analyzer (OST/TMS ID 2317), Paint Scaler (OST/TMS ID 2952) and PCB Analyzer (OST/TMS ID 2398).

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Release of Concrete for Recycle from Decontamination and Decommissioning Projects—Accelerated Site Technology Deployment

The concrete crusher being loaded with concrete debris.

Objective and Scope: While most of the concrete waste generated during D&D activities is not contaminated, some portions are contaminated with radioactive or chemical constituents. Because of the difficulties and uncertainties associated with the unrestricted release of concrete, much of the uncontaminated concrete is treated as though it were contaminated and is disposed as low-level radioactive waste. Even concrete that is shown to be uncontaminated is disposed either in a sanitary landfill, or is used as backfill. Disposal at a radioactive or sanitary waste site can be costly and eliminates the opportunity to economically recycle or reuse the concrete.

The INEEL ASTD project, in collaboration with ANL-E, will develop and test a protocol for the free release of concrete. The protocol, to be developed by the ANL-E, will follow the ten basic steps for free release outlined in DOE Order 5400.5, and will be modeled after the protocol for the free release of scrap metal previously developed by the ANL-E. In short, the protocol will be a decision tree that takes into account factors such as the type and level of contamination, volume and type of concrete, stakeholder and public approval and the cost of decontamination. Based on this information,

the protocol will outline possible disposition alternatives for the concrete and their relative costs. The protocol will be applicable across the DOE complex. Once the protocol is written, it will be applied to a test case at the INEEL to assist with planning D&D of a facility. The protocols will then be shared with others within the DOE complex so that it can then be applied on a complex-wide basis to reduce the cost of D&D operations involving concrete removal by allowing for re-use of concrete that meets EPA regulations and DOE orders.

Status and Accomplishments: Although many relatively small facilities have previously been decommissioned at the INEEL, many large facilities await decommissioning. Facilities such as the Engineering Test Reactor (ETR), Materials Test Reactor (MTR), Power Burst Facility (PBF) and a variety of waste handling and laboratory facilities will be decommissioned over the next several years. Each of these facilities contains massive amounts of concrete, which represents tremendous savings potential if it can be re-used. The amount of contaminated concrete at the INEEL is estimated to be as low as 278,000 ft^3 and as high as 354,000 ft^3, while the non-contaminated concrete (including that in the landfill) is estimate at 7.7 million ft^3.

Current Reporting Period Activities: The preliminary draft of the Protocol for the Re-use of Concrete was received from the ANL-E on February 29 and reviewed by the INEEL team. On March 7 a meeting took place to review the draft protocol and discuss how it relates to existing INEEL procedures. INEEL personnel from Radiation Engineering, D&D Operations and Environmental Remediation Technologies attended the meeting. The discussions provided the ANL-E with details about the INEEL radiation survey and release procedures, D&D Operations and how disposal options are currently evaluated, and the concrete crusher. The team reviewed candidate INEEL facilities and selected the Central Facilities Area (CFA) Sewage Treatment Plant to use as a test case for the new protocol. Information to support the protocol was sent to the ANL-E, including INEEL procedures and data on the CFA Sewage Treatment Plant concrete volumes, contaminants, facility and process descriptions and disposition methods chosen. In addition, a summary of common concrete cleaning methods with their capital and operational costs and throughput rates was provided.

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Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites—Accelerated Site Technology Deployment

Objective and Scope: One of the most significant issues facing planners of D&D projects is the cost associated with characterization of the facility. There is uncertainty concerning the amount of data that needs to be collected and the level of analysis required in all phases of a D&D project, from the initial planning phase through the closure phase. These uncertainties make it difficult to define the full scope of a project at the outset and to prepare, with confidence, a feasible D&D schedule. This ASTD project plans to address some of the most important issues associated with facility characterization through the implementation of the guidelines contained in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Additionally, this ASTD project will augment the MARSSIM process through deployment of innovative in situ characterization technologies. This effort focuses on the characterization of the Brookhaven Graphite Research Reactor (BGRR), which is currently undergoing stabilization in preparation for near-term D&D.

Status and Accomplishments: To date, the focus of MARSSIM, a regulatory guidance document developed collaboratively between DoD, DOE, EPA, and the Nuclear Regulatory Commission (NRC), has been for final status surveys used in determining if a remediated site/facility meets the applicable release criteria. The application of the MARSSIM process at the BGRR facility for initial investigation prior to remediation of decommissioning activities represents one of the first applications of this kind within the DOE complex.

Utilizing MARSSIM, coupled with the in situ measurement technologies the In Situ Object Counting System (OST/TMS ID 2098) and BetaScint Fiber-Optic Sensor (OST/TMS ID 70), the radiological and hazardous material conditions of the BGRR facilities will be determined. Cobalt-60 is one of the primary nuclides of interest. Other anticipated radionuclides are tritium, carbon-14, strontium-90, cesium-137, radium-226, uranium-235, and various transuranics. Knowledge of the existence and extent of the radiological and hazardous material conditions will enable timely stabilization of the facility, provide for necessary modifications and/or repairs, and establish the basis of any future decommissioning planning.

Current Reporting Period Activities: Over the past several months the In Situ Object Counting System (ISOCS) and the BetaScint have been used to conduct characterization of the BGRR facility and surrounding soils. The ISOCS with its ability to model complex geometries was used to characterize above-ground ducts, Fan House 5, and the Pile Fan Sump including excavated soil analysis. Real-time analysis of approximately 600 soil samples was conducted over a four-week period. The ISOCS provided an estimated cost saving of $150,000 over baseline laboratory analysis and accelerated schedules by two months. Soil analysis was also conducted using the BetaScint for strontium-90 and uranium-238. Using this near real-time technique, sample analysis ranged from $35 to $60 per sample compared to laboratory analysis, which takes one to four weeks at a cost of $200 to $300 per sample. Through implementation of the MARSSIM and deployment of these in situ techniques, the ASTD project is showing positive results in lowering characterization costs, accelerating project schedules, providing improved data quality and reducing personnel exposure.

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▼Deactivation & Decommissioning (D&D) Consortium

Objective and Scope: In December 1997, DOE signed a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) and several nuclear utilities to jointly develop and deploy new D&D technologies. DOE's objective is to expand the reach of benefits of the leading-edge technologies being deployed within the DOE nuclear complex. The MOU Consortium established a charter in early 1998 and identified challenging technological areas common to both DOE and the commercial industry. Both DOE and commercial sites will be used for these demonstrations and deployments.

DOE and EPRI are collaborating to conduct quarterly workshops at various nuclear plants around the country, each focusing on a particular decommissioning area. DOE and the utilities present the most recent, innovative technologies to improve productivity and worker safety while reducing cost. The workshops will solicit feedback from "hands-on" plant managers and field workers. Topics covered to date address: concrete decontamination, imbedded pipe decontamination and site characterization.

Status and Accomplishments: The efforts supporting the DOE/EPRI/Utility Consortium during the past quarter concentrated on the planning and execution of the first technology demonstration at the Rancho Seco Nuclear Power Plant. The test plan was written and approved during January and

February. A second set of technology demonstrations is planned for the second quarter of the year.

The first technology demonstration involved the concrete shaving technology developed by Marcrist Industries, Ltd. Demolition Technologies of Greenville, Alabama holds the license for distribution of this technology in the United States. Two separate pieces of equipment were demonstrated. Both use a diamond-impregnated shaving drum as the cutting tool for removal of the concrete surface. Dust that is generated is collected by a vacuum system and deposited in a waste drum.

The first piece of equipment is a self-propelled, electric powered floor shaver. It was demonstrated on clean and radioactively contaminated floor areas in the reactor turbine building. Several parameters were recorded as part of the demonstration and the technology was well accepted by the operating staff.

The second piece is a hydraulically powered wall-shaving unit. For purposes of the demonstration, the unit was mounted on a forklift. This allowed the device to be positioned on the wall. Again data was collected and will be reported in a technology demonstration report.

The second demonstration planned will be a demonstration of the FIU technology to measure decontamination as work progresses. This will be used in conjunction with a floor cleaning technology using shot blasting for floor decontamination. It will also be used with a wall walking technology vs. the Marcrist Shaver. Demonstration is scheduled in May and June. Planning work for these demonstrations began during the quarter.

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Florida International University

Objective and Scope: The Hemispheric Center for Environmental Technology (HCET) at Florida International University (FIU) in Miami, Florida, is working on several D&D-related research projects under a grant awarded by the DOE Office of Science and Technology. These FY 2000 projects include:

- Deactivation and Decommissioning Technology Assessment Program
- Integrated Vertical and Overhead Decontamination System
- In Situ Pipe Decontamination System
- Technology Information Management and Dissemination
- Size Distribution and Rate of Production of Smoke and Particulate Matter During the Cutting of Metals
- Mercury Contaminated Material Decontamination Methods Investigation and Assessment
- PCB Contaminated Coatings Treatment System Development
- Technical Assistance and Response Development
- Online Measurement of the Process of Decontamination
- Remote Surveillance of Facilities Awaiting Deactivation and Decommissioning
- Volumetric Lead Assay

The Marcrist Wall Shaver being demonstrated as part of the Technology Assessment Program.

Status and Accomplishments and Current Reporting Period Activities:

Significant events for this reporting period

- Demolition Technologies Inc. demonstrated the Marcrist Diamond Wall Shaver on a Brokk 250 platform for its capability of coating removal and aggressive removal of masonry surfaces on February 22-28, 2000. The demonstration was very successful, although it encountered some downtime. A technology evaluation report will be issued in May.
- Keibler Thompson Corporation demonstrated two remote-controlled demolition machines, the KT-30 and KT-15 for equipment dismantlement and concrete demolition, on March 7-9, 2000. These machines proved to be extremely efficient in dismantlement and demolition work. A detailed technology evaluation report will also be published in May as part of that month's progress report.

Accomplishments and technical progress to date

Under this project and earlier technology assessment projects funded from other sources, FIU-HCET assessed over 60 baseline and innovative technologies for decontamination and equipment dismantlement under standardized, non-nuclear testing conditions. Many of the technologies identified for demonstration at FIU-HCET are selected to address the needs identified in the EM-50 Needs Management System (*http://EMNeeds.em.doe.gov/Home/*). As a result of these assessments, directly comparable performance data related to operations and maintenance, primary and secondary waste generation, and health and safety have been compiled. This data has been valuable in assessing whether a technology meets the screening criteria for those DDFA LSDDP's where these technologies are being considered, as well as assisting EM-30 project managers in making decisions on the deployment of innovative technologies. Technology assessment data is managed using a Microsoft Windows-based multimedia information system.

To date in FY 2000, three (3) demonstrations have been completed.

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▼AEA Technology DDFA Projects

The Department of Energy (DOE) engaged AEA Technology, through an International Agreement, to bring a UK perspective to U.S. decommissioning activities within the DOE-complex. AEA's contributions

are broad in nature and include planning as well as specific technology contributions. Through this International Agreement with DOE, four new D&D-related Project Technical Plans (PTP's) have been initiated for FY00. The concept and scope for each of these PTP's is briefly discussed as follows:

Demonstration and Deployment of a Passive Ventilation Device for D&D Activities at the Savannah River Site: Ventilation control has classically been conducted using a pressure sensor, controller, valve actuator and mechanical air-regulating valve to vary the flow of air and the depression in a system. Should the dynamics of the system under control vary, there is a finite time for the mechanical system to adjust while the signal from the pressure sensor travels to the controller as it opens or closes the mechanical valve to regulate the flow. The system is always lagging behind what is happening in the unit under control, and under certain conditions this can be detrimental to operations and/or hazardous to workers.

To overcome this situation in the UK, AEA developed a non-mechanical, part passive ventilation valve that responds instantaneously to the behavior of the system. This device, known as a Vortex Amplifier or VXA, has no moving parts and is maintenance free. It is able to react instantaneously to pressure variations in a system, and is therefore inherently more reliable and more efficient than conventional pressure equalizing systems. The scope of this PTP is to design, fabricate, and demonstrate two vortex amplifiers for separate applications at the SRS, offering a reliable, proven alternative with a better track record as compared to conventional mechanical systems.

Demonstration and Deployment of Soft Media Decontamination Techniques for Various Applications at the Savannah River Site: DOE has a large inventory of contaminated lead currently stored throughout the complex with more being added as DOE and its contractors decontaminate and decommission facilities. For example, the SRS currently has 200 to 300 tons of stored lead that must be decontaminated in an efficient, cost-effective manner. The ANL and INEEL also have a similar problem and have expressed a need to identify a cost-effective and reliable technology with a proven track record to decontaminate lead prior to final disposal.

AEA has extensive experience in designing, building and operating pliant media blast systems in high radiation environments, particularly in the commercial nuclear sector. Therefore, although pliant media decontamination is not a new technology, it has not been extensively demonstrated or deployed in the DOE complex for these applications. In this PTP, AEA will use its commercial deployment experience to perform a hot demonstration of lead brick decontamination at the SRS. Demonstrating the effectiveness of the sponge blasting system is expected to lead to future deployments throughout the complex.

The SRS has also expressed a need for a decontamination technology for contaminated tank riser plugs and pump transport vessels. In addition to performing the hot decontamination demonstration on contaminated lead bricks, AEA will demonstrate the effectiveness of the pliant media blast system on a contaminated tank riser plug. During the operation phase of these demonstrations, AEA will train Savannah River staff on proper procedures for decontaminating these components using a sponge blasting system.

Inspection, Sampling, and Remediation Options for Tank 105 in the HLW Vault in Building 324 at Hanford: To date, the DOE complex has primarily focused on closing large radioactive tanks and decontaminating and decommissioning smaller, low-level radioactive tanks at the various sites. In the coming years, several high profile projects that involve highly radioactive waste tanks will need to be inspected, characterized, emptied and then dismantled. Due to the significant radiation dose and costs associated with these activities, an innovative, integrated approach to these activities is needed, which will deliver significant benefits in terms of increased safety, reduced costs and shortened schedules.

As part of the overall decommissioning plan at the Hanford site, it is planned to close Building 324. One of the major projects involved in closing this building is the removal

and disposal of four tanks in the high-level waste vault located beneath the hot cells in the building. These tanks, T104, T105, T106 and T107 are of the classic "Idaho" design and have limited access with all pipes having fully welded connections.

The purpose of this PTP is to conduct a feasibility study to examine several key aspects of the preparatory work leading to the temporary use and eventual D&D and removal of Tank 105. The principal stages of this process are envisioned to be:

- Inspection—deployment of a visual/ imaging system into the tank to view the internals
- Radiation monitoring—to get an accurate radiation measurement
- Sampling—retrieval and analysis of a sample of waste to determine waste composition
- Decontamination—removal of the tank waste contents

This PTP will develop an integrated strategy for conducting all of these preparatory tasks using, in all likelihood, a single point of entry into the tank. Streamlining this preparatory work will reduce dose uptake to workers, reduce costs and shorten the overall timescales, allowing remediation of Tank 105 to be accomplished earlier in the deactivation schedule.

Demonstration of Tension Diamond Wire Cutting System for the Cutting of Complex Steel Components, Including Components with Extensive Internal Voidage: An alternative system to wraparound diamond wire systems has been used in the UK for the size-reduction of large, hollow steel components in radioactive environments. This method is to tension the diamond wire on a frame, and then to use the wire in a similar manner as a band saw. As the length of the wire remains fixed for the duration of the cut, adjustments to the wire tension and feed of the wire can be carried out remotely. Also, continuous wires can be used, thus eliminating the crimp connector who is used to join the ends of the wire for the wrap around systems. Failure of the crimp joint is a major cause of wire breakage during cutting.

Through this PTP, AEA will undertake a series of demonstration cuts using a tensioned diamond wire system to cut large, heavy-walled steel components. The components selected will be representative of items that are routinely encountered within the DOE complex, and will evaluate key technical and cost savings aspects of this cold cutting technique

Current Reporting Period Activities: The revised implementation plan for the Tank 105 access, characterization, sampling and clean out effort at Hanford's 324 Facility was submitted to the DDFA. AEA also delivered a draft report on advanced tooling for size reduction operations. This report is currently being reviewed.

The DDFA reviewed test plans for deploying pliant media blasting technology. The plans are to decontaminate lead bricks/ sheets and tank riser plugs. An area of concern focuses on the generation of airborne contamination. AEA modified test plans for the deployment of pliant media blasting technology to address comments and concerns. A PTP is expected from AEA.

The DDFA has also brokered discussions between AEA and the INEEL for the development of a work package in which large thick-walled reactor components would be size reduced, using the tension diamond wire technique. The DDFA is also brokering discussions between AEA and Hanford site representatives that focus on the K3 ducts at WESF.

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2.2 Facility Characterization

Portable X-Ray K-Edge Heavy Metal Detector

Objective and Scope: Ames Laboratory and Iowa State University's Center of Nondestructive Evaluation are developing an improved nondestructive assay (NDA) technique for detecting and quantifying uranium, plutonium and other heavy metals. The work is focused on situations where these materials are located inside sealed containers or processing equipment. The approach this technology uses is based on observing the K-edge absorption transition in x-ray transmission measurements. This technique is being developed to maximize the sensitivity for detecting heavy metals while minimizing the measurement time.

A project study showed that the K-edge heavy-metal detection technique would be beneficial for many D&D projects, especially those involving gaseous diffusion plants. Its use could have the biggest impact in inspecting the vast amount of piping in the plants. This inspection could be done in situ to allow monitoring of chemical flushing. The high sensitivity of the technique can be used to minimize the danger of contamination to workers and equipment during disassembly operations, resulting in savings of time and money in addition to reducing generation of waste.

Status and Accomplishments: During the first year of the project, FY 1994, the sensitivity of the technique was determined through modeling and laboratory demonstrations, ending with a design of a portable system. In FY 1995 and FY 1996, a prototype portable K-edge, heavy-metal detector was assembled and tested in the laboratory. This system consisted of a high-flux x-ray generator, a collimator for minimizing the local radiation hazard and providing the requisite beam characteristics, a monochromator, a real-time imaging detector for simplified alignment and an energy-dispersive detector for collection of the K-edge data. The equipment, including the x-ray generator and detectors, is controlled by a personal computer. The same PC analyzes the raw data, with the result being made available to field personnel. Sensitivity comparable to the original laboratory tests was achieved, and measurement time was reduced by a factor of two. A 2-mm layer of uranium was successfully measured through 1 inch of steel. The K-edge system analyzed thorium contamination in seven drain lines in Wilhelm Hall. Minimal contamination was found in two lines, significant thorium contamination in three lines, mercury contamination in one line, and one case of a drain trap contaminated with uranium, thorium and mercury. This was the first true in situ demonstration of the K-edge system. The K-edge system was demonstrated at the Savannah River Site to measure the amount of highly enriched uranium (HEU) in the rooftop ventilation ducts for the Machining Room lathes. Sixty-six wide-angle images and 66 narrow beam spectroscopic shots were made during the demonstration. Approximately 84 feet of ventilation duct were assayed. When gram quantities were found, the precision was in the ±3 percent range. About one quarter of the narrow beam measurements identified a significant amount of HEU.

Current Reporting Period Activities: No activities to report this quarter.

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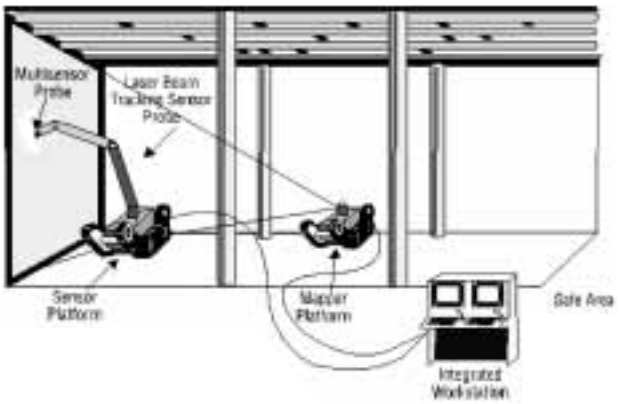
The K-edge technology is effective even through 1-inch-thick steel.

Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS)

Objective and Scope: Coleman Research Corporation will develop a remote system that can rapidly analyze in situ hazardous organic and radionuclide contaminants on structural materials. This remote system is the 3D-ICAS. The 3D-ICAS consists of a mobile sensor platform and a mobile mapper platform that operate in contaminated areas, and an integrated workstation that remains in a safe location. Development of this technology will occur in three phases.

Status and Accomplishments: The 3D-ICAS was successfully integrated with mobile platforms at the Oak Ridge National Laboratory (ORNL). The Coherent Laser Radar Mapper was operated on the OmniMate robotic platform and the contaminant analysis units and robot arm carrying the multisensor probe head were integrated on the overhead transporter. The system was subsequently demonstrated at Oak Ridge National Laboratory, Robotics & Process Systems Division in October 1998. The demonstration was conducted in the hi-bay area using a wall unit specially constructed for the demonstration. The wall unit consisted of pieces of cement-based wallboard and a small piece of an asbestos containing material. The wall unit was purposely contaminated with low-levels of organic materials, alpha emitters and a beta emitter. The demonstration consisted of mapping the wall unit, displaying the map, selecting points to be surveyed, running the contaminant survey, which required moving the sensor/analysis unit with the transporter and acquiring the sensor unit with the 3D mapper, displaying the measured contamination in real time and displaying detailed spatial and contamination data after the survey was completed. An unfortunate hardware failure the morning of the day before the demonstration prohibited acquisition of contaminant data from the high-speed gas chromatograph/mass spectrometer (HSGC/MS) and only the Molecular Vibrational Spectrometer (MVS) provided real-time identification of the substrate material during the demonstration. This was a significant success since the MVS correctly identified the wallboard as being cement even though the particular substrate sample had not been included in the system's neural network training set. Failure of the HSGC/MS was unfortunate, but its performance had been well documented and demonstrated prior to the demonstration at the ORNL. It did not detract from the main objective of the demonstration, which was to show end-to-end system operation with the 3D-ICAS mounted on the ORNL mobile platforms. The GC/MS was shipped back to Thermedics and they are in the process of replacing the parts and recalibrating the system. When complete the system will be shipped to the DOE-EM Laboratory in New York City for the validation testing.

Current Reporting Period Activities: A modification to the x-ray fluorescence (XRF) unit was made and is now integrated with the system. Coleman Research Corporation continues to test and debug the hardware on the integrated mobility platform. After completion of the integrated testing, the equipment will then be ready to begin system demonstration. Coleman is in discussions with FIU personnel to bring the mockup test wall, which they have prepared, to the Coleman facility in Boston for testing. The purpose of this demonstration is to show the operation of the system mounted



Three-Dimensional Integrated Characterization and Archiving System (3-D ICAS) is a remote mapper and sensor platform to use in contaminated areas.

on the mobility platform. The platform conveys the coherent laser range mapper, sensing robot arm subsystem, contaminant analysis unit and multi-sensor probe.

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OST/TMS ID 97

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Fast Response Isotopic Alpha Continuous Emissions Monitor

Objective and Scope: The objective of this effort is to develop and test Continuous Air and Emission Monitoring (CAEM) instrumentation for alpha-emitting radionuclides. This instrument will be designed in order to certify the proper performance of airborne emissions from ambient air and in equipment emissions encountered during D&D of DOE's surplus facilities. The proposed system will also meet DOE's alpha CAEM requirements through the development of an innovative, high-resolution, on-line air/gas alpha monitor. The instruments will be capable of operating either as a stack emissions monitor, a process control instrument, or for the control of off-gas from decontamination, dismantlement and air handling equipment.

Initial efforts will be focused on the development and evaluation of a rapid alpha-counting-based instrument to monitor ambient air and emissions to meet the monitoring and equipment control needs of surplus facilities undergoing D&D. This development will establish the feasibility of a prototype instrument for use in detecting radionuclides that are present, or create susceptibility to exposure, throughout the DOE complex. The prototype instrument will be tested under the supervision of DOE's Inhalation Toxicology Research Institute in Albuquerque, New Mexico. Based on the prototype results efforts may be continued to full-scale commercial prototype for demonstration in one of the DDFA's LSDDP's.

Informal meetings were held with various DOE CAEM end users. For example, the personnel associated with LANL's upgrade of their continuous air monitoring system for the Plutonium Facility at Technical Area 55 (TA-55) continue to be very interested in the further development of the Fast-Response CAM. LANL was interested in hosting the Phase II field test at the LANL TA-54 LSDDP.

Current Reporting Period Activities: Comparison tests were initiated with the prototype CAEM unit being compared with conventional filter analysis. The results obtained with the prototype instrument compared quite favorably with those determined with the conventional filter analysis. Thermo Power presented their preliminary results at the DDFA Mid-Year Review, and received a number of questions indicating a high level of interest.

A cost and schedule estimate was received for work proposed to extend the base phase of this project. The proposed work will better position Thermo Power for a deployment at a site in the future by demonstrating their current prototype CAEM unit, possibly in conjunction with the LSDDP at Los Alamos.

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2.3 Facility Decontamination

High Productivity Vacuum Blasting System

Objective and Scope: The objective of this project is to improve the productivity and economics of existing vacuum blasting technology, which is used to remove radio-active contamination, PCB's, and lead-based paint and provides worker protection by continuously recycling the material and dust from the decontamination tasks. This work will focus on redesigning and improving existing vacuum blasting components, including: blast head nozzles, ergonomic handling of the blast head by reducing its weight, brush-ring design, vacuum level regulator, efficiency of dust separator, and operational control sensors. The redesign is expected to enhance the productivity and economy of the vacuum blasting system by at least 50 percent of current vacuum blasting systems.

LTC Americas will develop the necessary mathematical models of air-particle flow in the nozzle, in the blast head and interface area, and in the dust separator to study the flow characteristics and interaction of the various elements of the system. The purpose of this model development is to increase the productivity and economy of existing vacuum blasting technology by 50 percent. Based on the results of this modeling effort, the contractor will experimentally test and verify that the above system components perform according to the mathematical simulations and complete the preliminary design of the components of the proposed system. This will include an overall configuration of the system including: material selection and testing, definition of the range of dimensional and weight parameters, conceptual arrangement or design of the blast head unit, and dust separator unit. Based on the prelim-inary design, the contractor will procure components, and perform fabrication and assembly of the proposed system.

The performance of the system will be evaluated in the laboratory mock-ups representing various clean-up situations and environments. The contractor will review, analyze, and interpret data collected from the tests and develop a productivity enhancement profile of the pre-prototype unit including economic analysis. Based on the laboratory test results, the contractor will modify, change, and make adjustments to enhance the capability of the system.

Status and Accomplishments: Phase I has been completed. In Phase I, mathematical models and related code to simulate the entire process numerically were developed. Based on the data from the model, an innovative rectangular nozzle and a new centrifugal separator were designed, manufactured, and tested. The tests were performed to verify the mathematical models. The numerical results agreed with the measured data with a devia-tion within 10 percent. Experimental results also showed that if the new inno-vative design rectangular nozzle replaces the
old circular nozzle, more than a 50 percent increase in productivity efficiency could be achieved. The newly designed centrifugal separator offers a high-efficiency separation increase from about 30 to 75 percent, even using finer abrasives.

Phase II has been initiated. In Phase II, a pre-prototype of the nozzle, blast head with wind curtain, sensors and dust separator will be designed, constructed and tested to assess the performance of the new design under controlled conditions at the contractor's facility.

Current Reporting Period Activities: The fabrication of the pre-separator (vibration separator) is complete, as is the main centrifugal separator. The pre-separator is designed to separate the large, low-density particles induced by cleaning concrete walls. The main centrifugal separator is designed to separate the fine steel grits from dusts. Their performance will be evaluated by practical testing. The operator interface module with controls and indicators has been designed and incorporated into the design in conjunction with a detailed mechanical design of the blasthead. The contractor is experiencing continued delays in having the prototype nozzles fabricated. Six nozzles, made of tungsten carbide and boron carbide, have been ordered. The schedule will be revised based on the nozzle delivery time from the company fabricating them.

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2.4 Facility Dismantlement and Material Disposition

Demonstrations of Light-Aided Technologies for Hanford D&D Projects

Objective and Scope: Pacific Northwest National Laboratory (PNNL) is demonstrating a laser-aided cutting technology with a 2.4-kW neodymium-doped yttrium aluminum garnet (Nd:YAG) laser system for the size-reduction of materials and equipment in high-radiation environments to assess its applicability to dismantlement efforts at Hanford and other DOE sites.

The B-Cell Cleanout Project at the Hanford 324 Building has necessitated the removal and size-reduction of several large, multi-ton chemical processing racks. The project has used commercial saws and hydraulic shears, a plasma torch and a water knife to cut up equipment in the hot cell. Each system has drawbacks, including low cutting rates, high waste generation, or applicability to a narrow range of metals and geometries. Nd:YAG laser systems are used for metal cutting in automotive facilities worldwide and in many other manufacturing plants. The focus of this demonstration is the remote use of a fiber-fed laser cutting system to: (1) size-reduce materials in a low-radiation, remote-handled environment (cold test), and (2) size-reduce equipment with minimal secondary waste generation and assess the capability, performance rate and effective life span in a high-radiation, remote-handled environment (hot test).

Status and Accomplishments: PNNL partnered with the Lumonics Corporation of Livonia, Michigan, in September 1996 to provide equipment for the laser-cutting demonstration. With the Lumonics provided laser, cold tests (non-radiological) were performed in the 324 building at Hanford and the technology underwent limited use in cutting a contaminated crane. At that point, this technology was ready for full-scale demonstrati on and deployment under specific operation conditions. The 324 building provided concerns and issues requiring resolution before deployment in a hot-cell could take place. Based on this input, a limited irradiation test was performed to determine at least to an order of magnitude the degree of radiation darkening exhibited by the fiberoptic cable. This was accomplished by irradiation of laser cables with a gamma source, then performing power measurements and photobleaching with an offsite laser.

Current Reporting Period Activities: The draft Innovative Technology Summary Report is being prepared.

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OST/TMS ID 1477

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Asbestos Pipe Insulation Removal System (BOA)

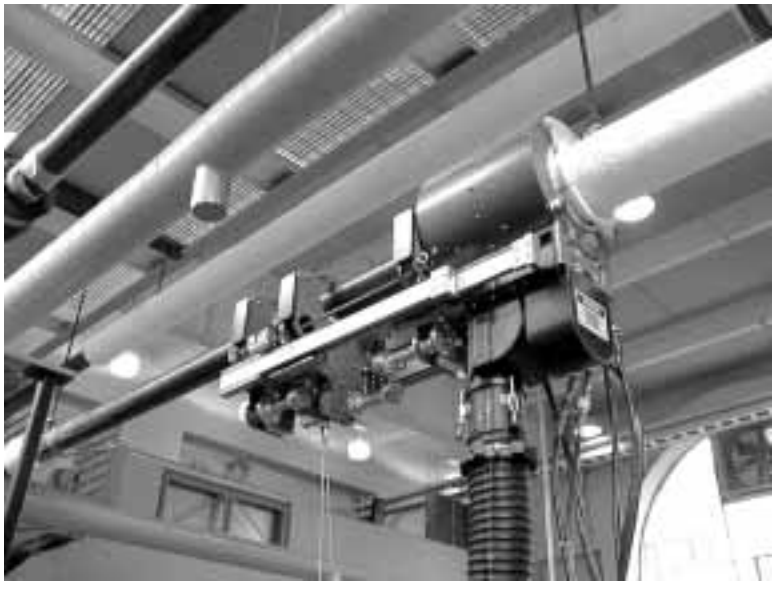
Objective and Scope: Most of the steam and process piping in DOE facilities is clad and insulated with asbestos containing material (ACM), which must be removed before any decontamination and dismantling activities can occur. Manual removal is expensive and time consuming because of the carcinogenicity of asbestos fibers, radiological contamination and abatement regulations of the EPA and the Occupational Safety and Health Administration. Carnegie Mellon University (CMU) is developing and demonstrating a mechanical asbestos removal system that can be remotely operated without a containment area. This technology, known as BOA, is a pipe-crawling, asbestos-removal robot supported by a mobile, boom-vehicle robot that places the pipe-crawling robot and then seals and bags removed asbestos.

Development of the BOA technology will occur in two phases over a two-year period. Phase I will develop a prototype BOA pipe-crawler robot. Phase II will

integrate the BOA pipe-crawler robot with the boom-vehicle robot.

Status and Accomplishments: Development of the prototype BOA pipe-crawler robot is complete. Laboratory demonstrations were completed at CMU and a field demonstration was completed at Oak Ridge in the back of K-1210 on the old K-25 site (now ETTP) in Oak Ridge, Tennessee. Air quality was independently monitored and found to be far below (by factors of 6 and 2, respectively) the EPA established limits of 0.1 fibers/cm^3 over an 8-h time-weighted average period and clearance samples below the maximum of 0.01 fibers/cm^3 for a 1500-L air sample. The two-operator scenario was demonstrated and shown to be workable, with all on-pipe and off-board logistics equipment essentially operating autonomously. During the field demonstration it became clear that it would be advantageous to harden certain features of the on-pipe system to allow it to work on the more prevalent 3-inch pipe at K-25 and Y-12.

The Asbestos Pipe Insulation Removal Robot System dubbed BOA placed second in a national design competition hosted by the renowned Design News trade journal/ magazine. BOA was selected from a large number of national entries, and it was judged one of the most innovative new designs and products in the United States in 1997/1998. Based on the performance of a robot abating at a rate of 30 linear feet per hour, compared with about 3 to 6 feet in DOE/industry, with associated per-foot abatement cost ranging between $25 and $150 for DOE/Industry, it was determined that substantial savings could be realized with the use of such a robot system. Overall abatement costs could decrease between 25 and 50 percent depending on whether the system replaces a current glovebag or full containment method. The BOA system will assist DOE in reducing the cost of asbestos abatement as part of decontamination and dismantlement activities across the weapons complex.



The complete system was tested on long runs and hanger-passes for 3-inch diameter piping. The complete on-pipe abatement head and off-board logistics system was hardened through lengthy and exhaustive abatement runs, all of which were performed on lagged insulation and included many hangers. The abatement productivity and reliability was maintained and the viability of using the system on 3- and 4-inch diameter piping was certified. With this, the BOA system was ready for field-testing.

The BOA robot was delivered to the Pentagon Wedge 1 Renovation Project in late June 1999. The robot abated a total of 6 feet, while running into continual problems with a very thick canvas layer covering the insulation – the cutters continually wrapped and clogged themselves with the canvas cloth, thereby, never being able to fully cut the insulation without continual manual clearing of the coverhead. Hence, the test was terminated because inspection of the BOA system revealed that it was totally immobilized and the CMU team could not readily repair it at the Pentagon. As a result, the BOA system was returned to Pittsburgh for repairs.

CMU has submitted a proposal to rectify the system for proper use in the future. The main activities to be accomplished are to bring the BOA system back into working condition and to focus on the rebuilding of BOA and testing with simulant material. After this, testing in an enclosure with wrap-and-cut sections of insulated piping system with real asbestos at an off-site contractor facility will occur. The rebuilding of BOA will include mechanical parts and some other failed components in the clamper and in the removal system and rewiring of the control-computer enclosure. Currently funding is not available to complete the effort. Additional funding to support the effort is being sought.

Current Reporting Period Activities: The BOA was selected as one among five projects nominated by the National Energy Technology Laboratory for the Energy 100 Award.

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OST/TMS ID 148

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Robotics Crosscutting Program

Objective and Scope: The Robotics Crosscutting Program (Rbx) supports the DDFA through technology development, close interaction with D&D Industry and University Programs funded through the NETL, and introduction of new robotics technology into the DDFA's LSDDP. Overall emphasis of the program continues to be design and integration of remote systems and capabilities used for facility deactivation and ongoing surveillance and maintenance activities with extended application to final facility D&D tasks. Deployment of remote D&D systems will reduce worker exposure to hazardous environments and provide productivity increases leading to substantial cost savings.

Status and Accomplishments: The major focus for Rbx in FY 2000 has been on three initiatives started in FY 1999. The first initiative, in support of the INEEL D&D program, will develop a low-cost D&D system that integrates the compact remote operator console with the Brokk demolition system to provide remote viewing and tool control capabilities.

The second new Rbx initiative is the development of telerobotic control capabilities for remote systems. Telerobotic control provides computer control of system operations, reducing the workload of the operator and increasing system effectiveness through more efficient execution of many tasks. The primary candidate for heavy manipulation in D&D is the Schilling Titan class hydraulic manipulator. DOE expertise in hydraulic control and robotic control systems provides an opportunity to enhance the control for the Schilling manipulators to allow telerobotic operation of these systems.

Hanford Canyon Facility

The final Rbx initiative started is the development of telerobotic systems for D&D of below-grade structures and equipment. There are many below-grade equipment enclosures (pits) with overhead access. Examples of such equipment pits are the filter pits at the INEEL and the much more numerous riser pits associated with the underground storage tanks at Hanford. The process cells within the canyon facilities are further examples of this type of environment. Most of these facilities have radiation or contamination levels that require remote operation for any characterization or D&D functions. These facilities represent target application sites for the telerobotic manipulation system based on the Schilling manipulator, the compact remote operator console and the telerobotic control capability.

Current Reporting Period Activities: A demonstration of the Modified Brokk Demolition Machine with Remote Console (OST/TMS ID 2938) to remove conduit and pipe was conducted at the INEEL Security Training Facility (STF) on January 18-19, 2000 (see February 2000 Update). The system, previously referred to as the "Low-Cost D&D System," consists of the modified remote Brokk (OST/TMS ID 2100) and viewing system, stand-alone facility camera and the compact remote console (OST/TMS ID 2180). The compact remote console (CRC) provides viewing and control of operations from a remote location. At the conclusion of the demonstration, the D&D operations personnel were so pleased with the system's performance they asked that they be allowed to complete the task using the remote robotic

equipment. D&D Operations personnel have also made several inquiries regarding the possibility of integrating the CRC with other remote D&D systems on site.

Current plans are to incorporate improvements (e.g., joystick control and audio feedback) into the system based on lessons learned from the demonstration and to deploy the enhanced system at the TRA-660 facility to remove two reactors later in the fiscal year. Mound has also expressed interest in deploying the CRC-enhanced Brokk system later this year.

During the reporting period, efforts continued to integrate and test software for the telerobotic control of the Schilling Titan II manipulator. Rbx project staff have been interfacing with the University of Tennessee (UTK) Robotics team to discuss integrating parts of the UTK Task Scene Analysis software into the next generation dual arm system, the dual arm telerobot (DATR). The CRC will be used as the operator interface for the telerobotic controls effort, and procurement of those components is now being initiated

PNNL staff participated in discussions with the OST program at Hanford's Office of River Protection (ORP) for possible early inclusion of advancements to the Telerobotic Manipulation System (OST/TMS ID 2939, previously referred to as the Equipment Pit D&D System). Enhancements include integrated controls, autonomous operation capability, and the CRC. The pit enhancement projects are one of the highest priority programs for the ORP. Under this task, the PNNL will coordinate with the Tanks Focus Area and the Rbx Tank Waste Retrieval product line in the design and development of a remote equipment pit operations system. The initial target application for the overall system is Project W-314 at Hanford. Future target applications include D&D of canyon process cells and other below-grade structures.

For more information:

OST/TMS ID 921

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2.5 Worker Safety and Other Projects

Protective Clothing Based on Permselective Membrane

Objective and Scope: Membrane Technology and Research, Inc. (MTR) is developing and demonstrating improved protective clothing that provides protection equivalent to current garments, but is lighter weight to improve comfort and is breathable to allow water vapor to escape, therefore reducing heat stress. Improved protective clothing will be made of an innovative fabric that combines an ultrathin, permselective outer membrane. The outer membrane is extremely permeable to water vapor escaping from the wearer, but highly impermeable to hazardous compounds. Fabric properties will be optimized and prototype suits well tested during Phase I. In Phase II, 20-30 suits will be fabricated and used in a variety of extensive, comparative trials in the laboratory and at a nonhazardous site.

Status and Accomplishments: Development of fabric materials and laboratory tests on the fabric have been completed. In laboratory tests, water vapor transmission rates of 600-900 g/m^2/day have been measured through the fabric. This water vapor transmission rate is far superior to butyl rubber suits with a water vapor transmission rate of 0-10 g/m^2/day. Chemical vapor transmission rates have been equal to or lower than the fabrics of commercial suits.

Two rolls of the fabric were laminated by Uretek. One roll of fabric (90 m by 30 in.), MTR1, uses rip-stop nylon as both inner and outer layers, and the second roll (40 m by 30 in.), MTR2, uses the rip-stop nylon on the outside and a flexible, lightweight, nonwoven fabric on the inside. The prototype suits manufactured by Kappler Systems received the following tests by outside laboratories: chemical permeation, physical properties, sweating mannequin, and heat stress modeling. In general, the results are not as good as expected: although the fabrics do combine water permeability and reduced heat stress with chemical protection, neither the chemical permeation resistance nor the reduction in heat stress were as high as hoped. The economic analysis was updated based on this new data. The analysis shows that MTR1 provides the greatest benefits in productivity; however, the benefit does not appear to justify the higher cost of the suit made of this fabric. MTR2 fabric has less productivity benefit and a higher selling price, and so is less attractive than MTR1.

The Phase II permselective garment testing by the International Union of Operating Engineers (IUOE) was concluded in August 1999. The garments tested, for personnel comfort and well-being of the worker while performing work, were those assembled by MTR's potential commercialization partner from the permselective fabrics supplied by MTR, Tyvek, and non-breathable garments like Saranex. The garments were all full bodysuits with hoods (for comparison purposes), and contained a more spacious cut in the chest and waist/crotch area than other manufactured garments, and this was very noticeable and appreciated by the test personnel. This also helped the garments to be more durable. Examples of tasks performed include crawling through confined spaces, performing metal grinding, and loading and hauling material in a wheelbarrow. The MTR garments, in general, were as comfortable, with respect to heat-stress, as the Tyvek garments, and extremely so, over the non-breathable garments. The test personnel all had very good comments concerning the MTR garments.

Current Reporting Period Activities: The IUOE has recently received the data back from the statistician and they expect to have the report on results of the garment testing completed some time during April 2000.

For more information:

OST/TMS ID 95

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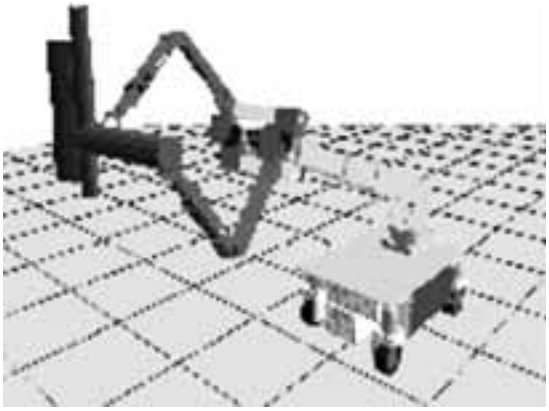
An innovative fabric combines an ultrathin, permselective outer membrane with a sorptive inner layer.



The Robot Task Space Analyzer will characterize the geometry of tasks for robots.

Robot Task Space Analyzer (RTSA)

Objective and Scope: The objective of this project is to develop, integrate and test a sensor and software system called the Robot Task Space Analyzer (RTSA), a tool that gives robot work system operators the ability to characterize the geometry of tasks to be performed. This geometrical data is necessary to allow selected robot tasks to be automated. The work is being accomplished by developing a combination of software, sensors and computing hardware that enhance the performance of robotic equipment used in typical environmental remediation and waste management projects.

RTSA is an enabling technology necessary for the deployment of telerobotic automation in D&D. It is conservatively estimated that effective telerobotics systems can increase the productivity of D&D remote operations by 10 to 30 percent. If only 10 percent of the projected D&D projects involve remote operations, telerobotic savings enabled through the RTSA could be from tens to hundreds of millions of dollars.

The RTSA combines laser and stereo imaging, human-interactive modeling, and semiautomatic object recognition to build a 3-D model of the work zone in which a robot system is operating. In future telerobotic worksystems, RTSA results will be accessed by automatic collision checking and motion planning routines to automate subtask execution.

Status and Accomplishments: The goals of the first phase are accomplished. A comprehensive design that has emphasized human interaction and human factors engineering principles has been completed. RTSA is a human interactive system that allows a remote operator to direct the construction of 3-D geometrical descriptions of the task objects (e.g., pipes, valves, tanks, etc.).

A laboratory test demonstration was performed in September 1999. The key objective in the development of the RTSA was to use the earlier work in task space scene analysis as a foundation for the development of an in situ geometrical modeling system. This system is a practical tool that typical remote equipment operators could use comfortably. The test results show that the current RTSA design achieves this important goal. Initial time results indicated that RTSA has the ability to construct models of a task space scene analysis layer on the order of minutes. Future work will involve the implementation and detailed evaluation of a complete RTSA system. All of the program will be executed on PC workstations with Microsoft NT operating systems. Tests will be performed on several task mock-ups with multiple subjects and trials at the Remote Technology Assessment Facility at the ORNL. In addition, the RTSA system will be integrated with the Dual Arm Work Platform to achieve a comprehensive and working telerobotic system.

Current Reporting Period Activities: A report that summarizes the project accomplishments was completed. The technical overview document describes the philosophy, hardware and software used and contains appendices, that provide more technical detail about the autoscan procedures, error and part placement results, and use of LINUX as a real-time operating system. A functions and requirements document was also produced that delineates the responsibilities of CMU's team and the desired functions of the finished RTSA code. The stereo and range autoscan procedures are successfully finding parts in regions selected by the operator. Coordinates of the parts are being derived and returned to RTSA. The dynamic link libraries that handle the communication between the laser range scanner and the image-processing computer were integrated. They were sent from CMU (subcontractor) and installed on the image-processing computer. In order to test them, the laser range scanner was run from CMU, and communication was handled over the Internet. This technology will be integrated with the ORNL Pit Riser project.

For more information:

OST/TMS ID 2171

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Integrated D&D Decision Analysis Tool

Objective and Scope: The objectives of this work are to develop a computer-based Survey Module, update the existing computer-based Decontamination and Decommissioning Technology Database Module, integrate the Survey Module and the D&D Technology Module and distribute the integrated software. FedTech, Arrey Industries, NES, and Research Triangle Institute have teamed to accomplish this effort. The existing D&D Technology Database Module being updated under this task was developed under a previous contract with Arrey Industries, NES, NEXI and Research Triangle Institute. The Survey Module will be able to cost effectively assist in preparation and execution of plans for initial facility surveys, operational surveys during D&D work and final facility release surveys. The Survey Module will estimate the budget, schedule, labor, radiation dose, waste generation, and equipment requirements to perform these surveys along with defining the number and location of survey points and recommended survey instruments. The Survey Module will integrate the collection, storage and reporting of survey data.

Current Reporting Period Activities: The team worked on report templates and content of reports.

For more information:

OST/TMS ID 173

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Modular Manipulator for Robotic Applications

Objective and Scope: This project focuses on the needs of Automated Plutonium Processing (APP) tasks that involve the manipulation of plutonium containers and the transfer of their contents. Specific challenges of APP glove boxes include restrictive entry ports, confined workspace, limited maintenance access and destructive plutonium particulates, which make this task virtually impossible to automate with existing technology.

In order for automation systems to be successful within DOE facilities; they must provide maximum functionality, flexibility, ease of use and reliability, while facilitating the rapid deployment of each custom system. This work concentrates on in-depth design and deployment of self-contained actuator modules, which will be used to construct a robotic manipulator tailored for APP tasks. A human-scale manipulator will be built from two sizes of DISC Actuator and will replace existing human labor within plutonium gloveboxes. The modular nature of ARM Auto-mation's technology readily enables installation and maintenance of automation within "hot" boxes.

Status and Accomplishments: A survey of the state-of-the-art modular manipulators design is completed. This survey addresses modular manipulators developed inside government laboratories, universities and private industry for such applications as space exploration or control research and commercially viable industrial applications. Based on this study, it is possible to define the requirements of one manipulator system that can be used to conduct automated transfer operations within plutonium glove boxes and some D&D applications.

Development of the test plan for testing the manipulator configuration was initiated last quarter. This effort included determining the best manipulator configuration to fit in a glove box. A solid model of a glove box was obtained from Sandia National Laboratory to aid in this effort. A path was then planned for the testing of the manipulator. Discussions are being conducted with the end users, and their requirements are being integrated in the final product.

Current Reporting Period Activities: No activities to report this quarter.

For more information:

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3.0 Programmatic Structure and Organization

Within the Environmental Management (EM) organization, the Office of Science and Technology (EM-50), formerly the Office of Technology Development, has the overall responsibility to develop and demonstrate technologies and systems to meet DOE's needs for environmental restoration and waste management. The office works closely with the EM Offices of Waste Management (EM-30), Environmental Restoration (EM-40), and Nuclear Materials and Facilities Stabilization (EM-60) in identifying, developing, demonstrating,and deploying innovative, cost-effective technologies and systems. Activities within EM-50 include research, development, demonstration, testing, and evaluation (RDDT&E); technology integration; technology transfer; and program support.

Program Structure

To focus DOE efforts on the most urgent needs, EM-50 has established four focus areas that address DOE's most pressing problems:

- Deactivation and Decommissioning (D&D)
- High-Level Waste Tank Remediation
- Mixed Waste Characterization, Treatment, and Disposal
- Subsurface Contaminants Containment and Remediation

In addition, EM-50 has established three crosscutting technology areas that conduct efforts where technology needs and targets are relevant to more than one focus area. The crosscutting areas are:

- Characterization, Monitoring and Sensor Technology (CMST)
- Efficient Separations and Processing (ESP)
- Robotics

"It's time we elevate the profile and prestige of this world-class facility, which has been helping solve energy and environmental problems for more than 50 years,"

Bill Richardson, U.S. Secretary of Energy, National Energy Technology Laboratory Dedication Ceremony

The Industry Program conducts competitively selected activities that involve the private sector in developing, demonstrating, and implementing improved technologies that address the needs of the focus areas and the crosscutting areas.

The result of this structure of programs is that the D&D Focus Area is positioned to support those research areas defined as highest priority by EM-50 and DOE customers.

The Role of NETL

The Federal Energy Technology Center, with physical sites in both Pittsburgh, Pennsylvania and Morgantown, West Virginia, was redesignated by U.S. Secretary of Energy Bill Richardson, as the National Energy Technology Laboratory (NETL). As the 15th national laboratory, NETL becomes part of the national laboratory research system. This is the largest research system of its kind in the world with more than 30,000 engineers and scientists conducting research and research and leading-edge experiments. As part of this system, the new National Energy Technology Laboratory will join Argonne National Laboratory (Illinois); Brookhaven National Laboratory (New York); Lawrence Berkeley National Laboratory (California); Fermi National Accelerator Laboratory (Illinois); Idaho National Engineering & Environmental Laboratory (Idaho); Lawrence Livermore National Laboratory (California); Los Alamos National Laboratory (New Mexico); National Renewable Energy Laboratory (Colorado); Oak Ridge National Laboratory (Tennessee); Pacific Northwest National Laboratory (Washington); and Sandia National Laboratories (New Mexico and California).

Rita A. Bajura, NETL Director, a career federal executive with more than 18 years experience in government-industry energy partnerships, continues in her leadership position as head of the single management team that serves both physical sites with a combined working force of more than 530 federal scientists, engineers, and administrative staff. NETL is responsible for nearly 600 research projects; most involving the development of advanced fossil fuel technologies.

In addition to the new national laboratory's core capabilities, Secretary Richardson announced that a newly created Center for Advanced Natural Gas Studies, would be an integral part of NETL's research endowment.

Senator Robert C. Byrd, (WV) remarked in the course of the dedication that, "Much of the laboratory's work is dedicated to the worthy goal of developing innovative, clean and efficient technologies that will allow our nation to meet its growing energy needs. As the nation's newest national laboratory, it will continue to help light a pathway for a new era of energy use that will ensure a comfortable standard of living for our children and our children's children."

NETL also manages a significant portion of the technology development needed to clean up sites in the government's nuclear weapons complex. In February 1995, the then Morgantown Energy Technology Center was selected by EM-50 to be the implementing organization for the D&D Focus Area. As such, it brought the experience gained from being the implementing organization for the Industry Program, which competitively selects industrial R&D performers through Research Opportunity Announcements (ROAs) and Program Research and Development Announcements (PRDAs). As the lead organization for D&D implementation, NETL is responsible for the planning, monitoring, and evaluating RDDT&E projects to meet the requirements of EM-50 and its customers in EM-30, EM-40, and EM-60.

▼ Stakeholder Feedback

The stakeholders in the D&D Focus Area include DOE headquarters; DOE operations offices; DOE sites and their operating contractors; D&D technology developers and users in the private sector; federal, state, and local regulators; and the communities around affected DOE facilities. These stakeholders have been providing input to focus area planning and implementation; program contacts are provided on the first page of this report.

4.0 BACKGROUND

The D&D Focus Area was established to develop and demonstrate improved technologies and systems that could solve customer-identified needs to characterize, deactivate, survey and maintain, decontaminate, dismantle, and dispose of or recycle DOE surplus facilities and their contents. The mission also includes facilitating the acceptance, approval, transfer, commercialization, deployment, and implementation of these technologies and systems.

These technologies are needed to address the pressing needs of deactivating more than 7000 contaminated buildings and decommissioning more than 700 buildings. In addition, material disposition is required for over 600,000 tons of metal and 23 million cubic meters of concrete in contaminated buildings and for 400,000 tons of metal currently in scrap piles. The major drivers for this focus area are the high safety and health risks associated with working in aged and contaminated facilities and the high costs associated with facility deactivation, sur-veillance, and maintenance using currently available baseline technologies.

D&D Focus Area Strategy

Subsequent to the selection of NETL as the lead organization for the D&D Focus Area, a program review of all FY95 projects was held in May 1995. Based on this and other recent program reviews, as well as the general requirement for fiscal constraint throughout, the following strategies were developed:

Programmatic Strategy

- Focus D&D technology development program on large-scale demonstrations emphasizing full-scale demonstrations using a suite of improved technologies.
- Demonstrate technologies only through large-scale demonstrations.
- Focus on technologies that are identified as high priority by customers, that have wide applicability, and that have a commitment to be considered for use by customers.
- Emphasize demonstration and deployment of private-sector technologies.
- Technical Strategy

In the near term, emphasize technologies to effectively support:

- deactivation of facilities,
- decontamination of surfaces,
- reuse of bulk contaminated materials,and
- application of remotely operated dismantlement systems

In the middle term, emphasize technologies to effectively support:

- applications of remote surveillance systems,
- characterization of volumetrically contaminated materials,
- decontamination of bulk materials, and
- adoption of release standards for bulk contaminated materials.

Large-Scale Demonstrations

A cornerstone of the D&D Focus Area is its series of large-scale demonstration and deployment projects. The LSDDPs demonstrate innovative and improved D&D technologies at full scale, side by side with existing commercial technologies. The intent is to compare benefits from using a suite of improved and innovative D&D technologies against those associated with baseline D&D technologies. This approach provides an opportunity to test improved and innovative D&D technologies at a scale that will provide meaningful cost and performance information to the potential end-users of the technology.

5.0 Upcoming Events

The following conference/workshop may be of interest to those with a stake in D&D cleanup activities.

September 2000

Spectrum 2000

Chattanooga, Tennessee

September 24–28, 2000